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A survey of the Ophioninae (Hymenoptera: Ichneumonidae) of tropical Mesoamerica with special reference to the fauna of Costa Rica

Ian D. Gauld

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Synopsis

The Mesoamerican representatives of the ichneumonid subfamily Ophioninae are reviewed and a key is provided to the 12 genera occurring in the region. The species of *Enicospilus* occurring in (116) or on the periphery of (3) the area are revised and a key provided to facilitate identification of the Central American, Caribbean and North American species. In total 88 new species of *Enicospilus* are described, and the 32 other species are re-described. Ten new synonymies and one replacement name are proposed. The Mesoamerican species of *Agathophiona*, *Stauropoctonus* and *Rhynchophion* are redescribed. *Janzophion*, *Sicophion*, *Eremotylus*, *Simophion*, *Prethophion* and *Ophiogastrella* are all newly recorded from Mesoamerica; a single new species of each of the first three genera is described, a new combination, *Simophion melanostigma* (Cameron), is proposed and a species of *Prethophion* is re-described. The 13 Costa Rican and Panamanian species of *Ophion* are revised and a key provided for their identification; 11 of these taxa are new. The four Costa Rican species of *Ophiogastrella* (three of which are new) are revised, and a key is provided to facilitate their recognition. An identification key is provided for the nine Costa Rican species of *Thyreodon*. Preliminary notes are given concerning the habitat preferences of all the species, their seasonal distribution, and host data. The geographical distribution of Mesoamerican ophionines is discussed.

Resumen

Se revisan las especies de *Enicospilus* (116) presentes el el área y sus sectores periféricos y se entrega una clave que facilita la identificación de las especies centroamericanas, caribeñas y norteamericanas. Se describen un total de 88 especies nuevas de *Enicospilus* y se redescriben otras 32. También se proponen neuvas sinonimias y una nominación de reemplazo. Se redescriben las especies mesoamericanas de *Agathophiona, Stauropoctonus* y *Rhynchophion*. También se registran por primera vez para Mesoaméricana los géneros *Janzophion, Sicophion, Eremotylus, Simophion, Prethophion* y *Ophiogastrella*: se describe una sola especie en cada uno de los tres primeros géneros; se propona una nueva combinación: *Simophion melanostigma* (Cameron), y se redescribe una especie de *Prethophion*. Se revisan además, 13 especies de género *Ophion* de Costa Rica y Panamá, 11 de las cuales son nuevas, y se entraga una clave para su identificación. Se revisan también 4 especies de *Ophiogastrella* de Costa Rica (3 de las cuales son neuvas) y se entraga una clave mediante la que se les reconoce más fácilmente. Se aporta, por otra parte, una clave de identificación de las 9 especies de *Thyreodon* de Costa Rica. Se da información preliminar concerniete al habitat preferencial de todas las especies, su variación estacional y sus hospederos. Se discute finalmente la distribución geográfica de los Ophioninae mesoamericanos.

Introduction

Neotropical ichneumonids are generally large and conspicuous insects, and there are numerous species in almost every habitat in Central America. However, woefully little is known about the biology of any of them. Townes (1969) estimated that there are over 17,000 species of Ichneumonidae in America south of the United States, but host records are available for only 130 (<1%) of the species (Townes & Townes, 1966). The host range, habitat preference and seasonal distribution of the great majority of species are totally unknown. In part this biological ignorance is due to the fact that there are virtually no identification manuals for tropical ichneumonids. Without the means for differentiating species, biologists are unable to collate their observations on these insects. If one cannot determine whether the big yellow ichneumonid that emerged from a saturniid larva is the same species as the one which emerged from the sphingid caterpillar what observation can a field biologist make about the parasitoid's host range? Without a clear perception of the species present in an ecosystem one cannot begin to ask a whole range of biologically interesting questions concerning, for example, host resource partitioning, host exploitation and interspecific interactions. Yet the answers to these questions may have tremendous importance for mankind because ichneumonids are common natural enemies of a variety of insect pests. There are many examples of ichneumonids being used successfully in biological control programmes in agriculture (Clausen, 1978), but such successes result from an intimate understanding of the biology of a pest and its parasitoids. A similar knowledge of the role of parasitoids in natural ecosystems is likely to be important for conservationists struggling to protect and re-establish our ever-diminishing tropical forests.

This work is an attempt to provide a taxonomic basis for studies on one large group of tropical ichneumonids, the Mesoamerican Ophioninae. Many members of this group will be familiar to field biologists as they are the large, yellowish brown, nocturnally active insects that are frequently encountered at night around lights. The ability of the female to inflict a painful sting renders them memorable to many entomologists. However, a few ophionine species are diurnally active. Generally these are strikingly large, predominantly black insects with black or patterned wings, and they may be seen flying in forest clearings or feeding from flowers. Both nocturnal and diurnal ophionine species are likely to be encountered frequently in the field, and their large size, slender appearance and characteristic venation renders them amongst the easiest of ichneumonid groups to recognize (see page 10).

Ophionines are of considerable potential interest to tropical biologists for a number of reasons. First, as mentioned above, they are common and distinctive insects, and large numbers occur in most tropical localities. Most are readily attracted to lights at night so large samples can be amassed relatively easily in habitats that are otherwise difficult to sample. Such ease of sampling permits ready comparison of the faunas of different habitats, or of the same habitat at different seasons. Second, many closely related species occur sympatrically and synchronously, and this situation offers scope for detailed studies of how these parasitoids are partitioning available host resources. Such studies are facilitated by the fact that ophionines are endoparasitoids of the caterpillars of many conspicuous larger Lepidoptera, so they frequently can be reared, and thus it is possible to establish host ranges for many species. Third, the subfamily has an intrinsic biological interest as it is one of the few groups of koinobionts (Askew & Shaw, 1986; see also p. 10) that is more species-rich in tropical rather than temperate habitats (Gauld, 1986*a*; 1987). Study of ophionines may help elucidate why koinobionts in general seem to be less species-rich in tropical habitats than they are in temperate ones. Fourth, as the group comprises both diurnal and nocturnal species, comparison of their structure and behaviour offers scope for evaluating some of the selective pressures operating on large tropical parasitoids. Fifth, several species are common parasitoids of lepidopterous pests in agroecosystems and forests (Rohlfs & Mack, 1983; Fritz *et al.*, 1986). A greater understanding of ophionine biology should enable man to exploit them more effectively for biological control purposes.

All of these areas of potential research rely on there being a sound taxonomic base to enable species to be identified and it is the purpose of this work to provide such data.

The area and material studied

Geographical scope of the study

This work is a study of the Ophioninae of Mesoamerica, a geographical area that, as here defined, comprises Mexico (excluding the states of Baja California, Chihuahua, Coahuila, Nuevo Leon and Tamaulipas) and all countries south to, but excluding, Colombia (i.e. Guatemala, Belize, Honduras, El Salvador, Nicaragua, Costa Rica and Panama). The study area also includes southern Florida and the islands of the Caribbean from the Bahamas and Cuba, south through Jamaica, Hispaniola, Puerto Rico, the Lesser Antilles to Trinidad. A few species are included in this study solely because their ranges touch on the periphery of Mesoamerica, but I have made no attempt to revise the numerous species restricted to South America proper. However, many of the Mesoamerican species have ranges that extend far south into South America and, where this is the case, I have documented their South American range.

Representation and distribution of material examined

In view of the broad overlap between the faunas of South and Mesoamerica, I have examined all the available types of all valid described species occurring in the entire Neotropical realm (for catalogue see Townes & Townes, 1966). I have made an attempt to examine the collections of all institutions with major holdings of Mesoamerican Ophioninae. The geographical coverage of these holdings combined is far from uniform or complete. The faunas of some areas, such as the mountains of the Honduran/Nicaraguan border or the forests of central Darién, Panama, are virtually unrepresented as they have never been sampled. Furthermore, in many countries vast tracts of natural vegetation have disappeared through the agency of man long before they were ever entomologically sampled. This is particularly true of forests on the dry Pacific coastal plains (Janzen, 1986), and of montane forests at altitudes where coffee thrives. Relatively little material is available from Honduras, Belize, Guatemala, El Salvador and Nicaragua, though some material has been seen from all these countries. I have seen reasonably large collections from southern Mexico, northern Panama and scattered material from the Caribbean islands. Good collections are available from southern Florida, but the most extensive collecting has been done in Costa Rica and central Panama.

A few habitats have been exceptionally intensively sampled. Pre-eminent amongst these are the seasonally dry forest of Santa Rosa National Park, Costa Rica (sampled by D. H. Janzen and W. Hallwachs), the lowland rainforest of Barro Colorado Island, Panama (sampled by H. Wolda), the mosaic of pasture/cloud forest at Monteverde, Costa Rica (sampled mainly by W. Haber, M. and P. Fogden) and the rainforest in Braulio Carrillo National Park, Costa Rica (sampled by A. and I. Chacon). Through the efforts of these dedicated people large samples of ophionines are available for several consecutive years from each of these sites. Analysis of this information has allowed me to make an assessment of the seasonality of many species at these sites. A number of other sites at a variety of elevations in Costa Rica and Panama have also been moderately well collected, including wet forest at Finca San Gabriel in northern Alajuela Province, C.R., the forest around Turrialba, Cartago Province, C.R., the disturbed habitat at Las Cumbres, Panama, and the montane habitat near Guadalupe Arriba, Chiriqui Province, Panama. The resultant data have enabled me to make preliminary statements about altitudinal zonation or habitat preference of certain species. Some details of the climate and vegetation of the Costa Rican habitats are provided by Boza & Mendoza (1981) and Janzen (1983), and the Panamanian habitats are discussed by Wolda (1987).

Dr D. H. Janzen and colleagues have been intensively rearing Lepidoptera in Santa Rosa National Park now for a number of years. Virtually all information about parasitoid hosts has resulted from this study.

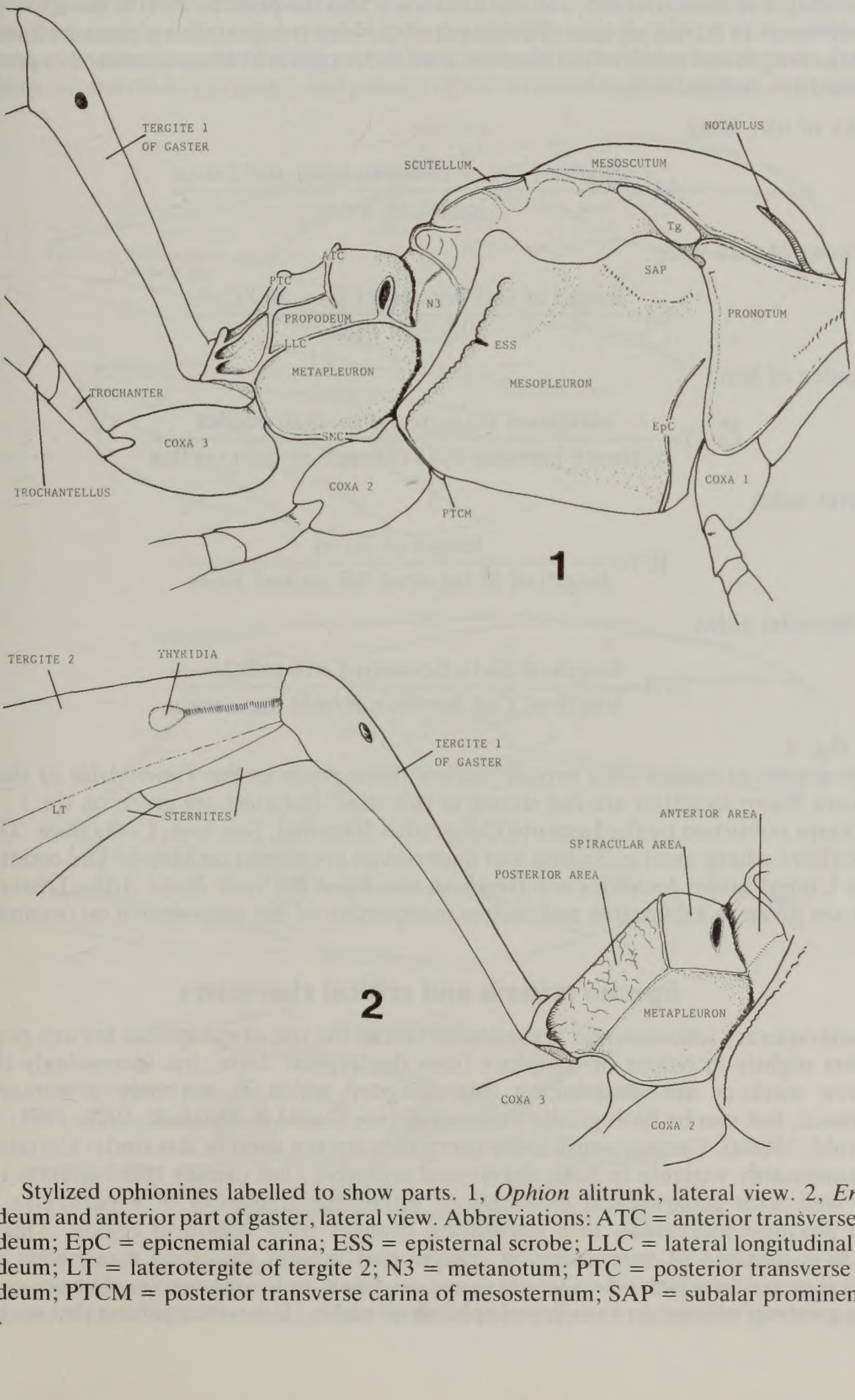
Depositories of material examined

The following abbreviations have been used for collections containing Mesoamerican Ophioninae.

BMNH	British Museum (Natural History)
CAS	California Academy of Sciences, San Francisco, U.S.A.
CNC	Canadian National Collection, Ottawa, Canada
FSCA	Florida State Collection of Arthropods, Gainesville, U.S.A.
IZPAN	Instytut Zoologiczny, Polska Akademia Nauk, Warsaw, Poland
MCZ	Museum of Comparative Zoology, Harvard, U.S.A.
MNCR	Museo Nacional de Costa Rica, San José, Costa Rica.
MNHN	Muséum National d'Histoire Naturelle, Paris, France
PANS	Philadelphia Academy of Natural Sciences, Philadelphia, U.S.A.
RNH	Rijksmuseum van Natuurlijke Historie, Leiden, The Netherlands
TC	Townes Collection, Gainesville, U.S.A.
TM	Természettudományi Muzeum, Budapest, Hungary
TMP	Transvaal Museum, Pretoria, Republic of South Africa
ULN	University of Leon, Nicaragua
UM	University of Michigan, Ann Arbor, U.S.A.
USNM	U.S. National Museum of Natural History, Washington D.C., U.S.A.
WC	Wahl Collection, Gainesville, U.S.A.
ZIL	Zoological Institute, Leningrad, U.S.S.R.
ZSBS	Zoologische Sammlung des Bayerischen Staates, Munich, West Germany

Terminology

The morphological terminology adopted in this work broadly follows that used by Richards (1956) and the names of the major features are shown in Figs 1–5. A few terms require some explanation. The definitive insect thorax is composed of three segments, but in the apocrite Hymenoptera the first abdominal segment (the propodeum) is intimately fused with the metathorax and quite unlike the remainder of the abdomen. In this work the thorax plus propodeum is called *alitrunk*, whilst the remainder of the abdomen, from segment 2 onwards, is called the *gaster*. These terms correspond to the terms mesosoma and metasoma that are widely used in North American literature. The propodeum of many ophionines is highly derived and


TERGITE 1 OF GASTER
SCUTELLUM
MESOSCUTUM
NOTAULUS
Tg
ATC
PTC
N3
SAP
PRONOTUM
PROPODEUM
LLC
ESS
METAPLEURON
MESOPLEURON
TROCHANTER
EpC
COXA 3
SMC
COXA 1
TROCHANTELLUS
COXA 2
PTCM
1
TERGITE 2
THYRIDIA
TERGITE 1 OF GASTER
LT
STERNITES
ANTERIOR AREA
SPIRACULAR AREA
POSTERIOR AREA
2
METAPLEURON
COXA 3
COXA 2

Figs 1, 2 Stylized ophionines labelled to show parts. 1, *Ophion* alitrunk, lateral view. 2, *Enicospilus* propodeum and anterior part of gaster, lateral view. Abbreviations: ATC = anterior transverse carina of propodeum; EpC = epicnemial carina; ESS = episternal scrobe; LLC = lateral longitudinal carina of propodeum; LT = laterotergite of tergite 2; N3 = metanotum; PTC = posterior transverse carina of propodeum; PTCM = posterior transverse carina of mesosternum; SAP = subalar prominence; Tg = tegula.

current standard terminology is unsuitable for it. In this work the nomenclature adopted by Gauld & Mitchell (1978; 1981) is followed (Fig. 2).

Various measurements and indices have been extensively used and these require explanation. The width of the face is the minimum distance between the eyes, and its height is the median vertical distance from the clypeal margin to the facial tubercle. The scutellar length and breadth are defined respectively as the length from the posterior rim of the scuto-scutellar groove to the posterior margin of the scutellum, and the distance across the posterior rim of the scuto-scutellar groove between the lateral carinae. The length of the hind trochantellus is measured mediodorsally and the length and depth of the hind coxa are the maximum values measured in profile. The indices used are defined thus:

Alar index of fore wing

$$\mathrm{AI}=\frac{\text{length of } 1\textit{m-cu} \text{ between bulla and } 2\textit{m-cu}}{\text{length of } 3\textit{rs-m}}$$

Cubital index of fore wing

$$\mathrm{CI}=\frac{\text{length of } \textit{Cu}1 \text{ between } 1\textit{m-cu} \text{ and } \textit{Cu}1\text{a}}{\text{length of } \textit{Cu}1\text{b}}$$

Frontal index of head

$$\mathrm{FI}=\frac{\text{maximum diameter of median ocellus}}{\text{distance between eyes through median ocellus}}$$

Intercubital index

$$\mathrm{ICI}=\frac{\text{length of } 3\textit{rs-m}}{\text{length of } M \text{ between } 2\textit{m-cu} \text{ and } 3\textit{rs-m}}$$

Second discoidal index

$$\mathrm{SDI}=\frac{\text{length of } \textit{Cu}1\text{a between } \textit{Cu}1\text{b and } 2\textit{m-cu}}{\text{length of } \textit{Cu}1 \text{ between } \textit{Rs}\&\textit{M} \text{ and } 1\textit{m-cu}}$$

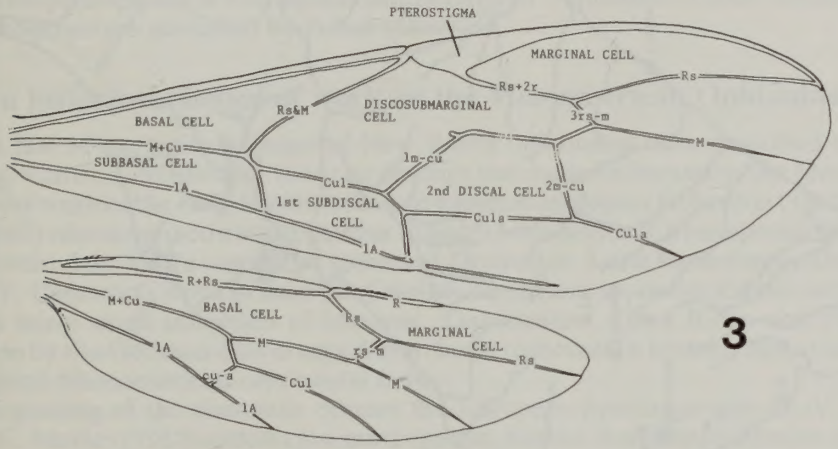
See also Fig. 4.

The geographical names used broadly follow those given in the *Times Atlas of the World*. Many Costa Rican localities are not shown in this atlas, but most are given on the 1 : 200 000 series of maps published by the Instituto Geografico Nacional, San José, Costa Rica. The Costa Rican localities where most collecting was undertaken are shown on Map 1. The county names given for United States localities are shown in the *Rand McNally Road Atlas*. Distances and altitudes are given in kilometres and metres irrespective of the units shown on original labels.

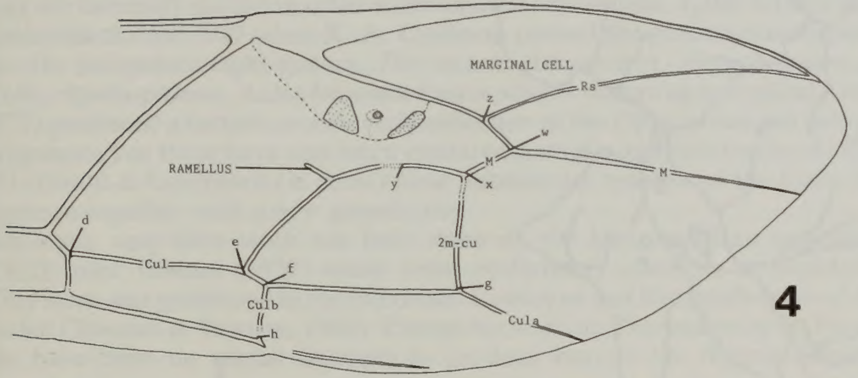
Species criteria and critical characters

Some contemporary ichneumonid taxonomists favour the use of subspecies for any population that differs slightly in colour or sculpture from the 'typical' form, but increasingly the more progressive workers are abandoning this category which is not only a nomenclatural encumbrance, but can be biologically misleading (see Gauld & Mitchell, 1978; 1981; Thorpe, 1980; Gauld, 1984*a*). Consequently these categories are not used in this study. Certain species are extraordinarily variable in both colour and sculpture, but usually this variation does not coincide well with geographical distribution; rather the frequency of a particular form of variation amongst individuals in a population changes from region to region. This is most marked in a number of very common species that inhabit disturbed ecosystems, such as agricultural areas, in which selective pressures are likely to favour species that are capable of attacking a variety of hosts in a variety of ephemeral niches. It is not surprising that such species should exhibit great phenotypic variation, as it is well known that development in different hosts or under different microclimatic regimes can profoundly influence the morphology or coloration of an insect (Myers, 1977; Liu & Carver, 1982; Pungerl, 1986). Species that inhabit climatically very stable habitats, such as montane rainforests, are often morphologically and chromatically extremely uniform throughout their range.

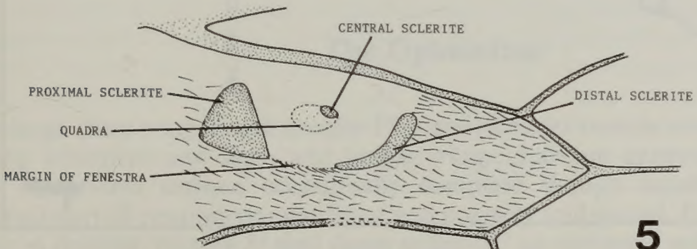
Gauld & Mitchell (1978; 1981) and Gauld (1985) have given exhaustive accounts of many of the critical characters of ophionines and this information is not repeated here. However, it is worth emphasizing that certain structural features (particularly the shape of mandibles, length of antennae, relative lengths of wing veins, form and number of the alar sclerites, form of the tarsal claws, stoutness of the gaster and pilosity of the terminal male sternites), which have been


PTEROSTIGMA
MARGINAL CELL
Rs
Rs+2r
Rs&M
DISCOSUBMARGINAL CELL
3rs-m
BASAL CELL
M
M+Cu
1m-cu
SUBBASAL CELL
1A
Cu1
2nd DISCAL CELL
2m-cu
1st SUBDISCAL CELL
Cu1a
Cu1a
1A
R+Rs
R
M+Cu
BASAL CELL
Rs
MARGINAL CELL
M
rs-m
1A
Rs
cu-a
Cu1
M
1A

3

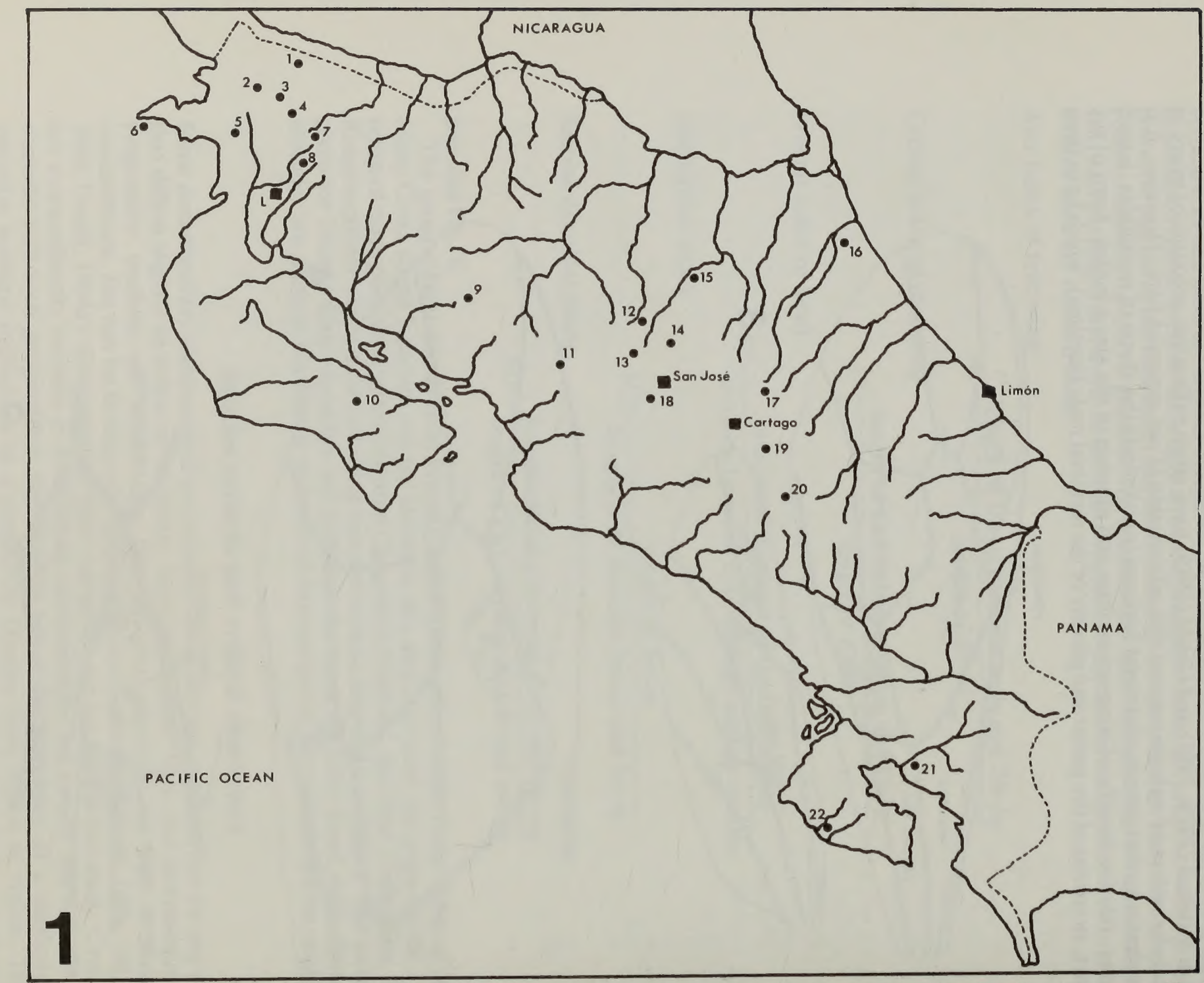

MARGINAL CELL
Rs
z
w
M
RAMELLUS
y
x
M
d
e
2m-cu
Cu1
f
g
Cu1b
h
Cu1a

4


CENTRAL SCLERITE
PROXIMAL SCLERITE
DISTAL SCLERITE
QUADRA
MARGIN OF FENESTRA

5

Figs 3–5 Stylized ophionine wings labelled to show parts. 3, *Ophion*, fore and hind wings. 4, *Enicospilus*, distal part of fore wing. Indices used in text are measured from the points indicated by letters d-g and w-z; AI = xy/wz; CI = ef/fh; ICI = wz/wx; SDI = fg/de. 5, *Enicospilus*, alar sclerites of fore wing.


NICARAGUA
PANAMA
PACIFIC OCEAN
Limón
San José
Cartago
L
1
2
3
4
5
6
7
8
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10
11
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21
22
1

Map 1 Costa Rica, showing the approximate locations of the principal ophionine collecting sites. 1, Santa Cecilia; 2, Cerro el Hacha; 3, Casa Maritza on Volcán Orosi; 4, Estación Mengo on Volcán Cacao; 5, Santa Rosa National Park; 6, Isla San José, Murcielagos Islands; 7, Finca San Gabriel; 8, Rincón de la Vieja National Park; 9, Monteverde Reserve; 10, Carmona; 11, San Ramón Forest Reserve; 12, Virgen de Socorro; 13, Volcán Poás National Park; 14, Braulio Carrillo National Park; 15, Finca La Selva; 16, Tortuguero National Park; 17, Turrialba; 18, San Antonio de Escazú; 19, Tapanti; 20, San Gerardo de Dota; 21, Esquinas; 22, Corcovado National Park. L = Liberia. Sites 2–6 are now included in the newly declared Guanacaste National Park.

used extensively to separate species in other regions, are also reliable for species separation in Mesoamerica. Similarly other features (such as the sculpture of the mesopleuron, metapleuron and posterior area of the propodeum) often show a considerable degree of intraspecific variation and are less reliable indicators of species-distinctness. Some Mesoamerican species, especially in the genus *Enicospilus*, have distinctive structural differences which have not been observed in species in other regions. For example, several Neotropical *Enicospilus* species have modified or incomplete posterior transverse carinae of the mesosternum (this carina is complete and unspecialized in almost all species from other regions), and a few have the second laterotergite pendant (it is folded up under the tergite in all species in all other regions). The position and completeness of the lower end of the occipital carina is also an important feature of several Neotropical species of *Enicospilus* and *Thyreodon*. A number of other critical characters of this latter genus are discussed by Porter (1984).

An historical résumé of work on the Mesoamerican Ophioninae

Although a few of the more widespread New World ophionines were described by classical authors (e.g. Christ, 1791; Brullé, 1846) no attempt was made to document the Mesoamerican fauna until the work of the early North American ichneumonologists E. Norton (1863) and E. T. Cresson (1865) who described a small number of north Mexican and Cuban species; in particular the latter author described a number of species of *Thyreodon*. Little further was published until 1886 when P. Cameron's work in *Biologia Centrali-Americana* appeared. Cameron's study was based on a fairly small collection of Mexican, Guatemalan, Costa Rican and Panamanian species made by the Godman-Salvin expedition, but it represents a first attempt at understanding the tropical Mesoamerican continental fauna.

At the beginning of the twentieth century the European hymenopterists G. V. Szépligeti (1906) and C. Morley (1912) added a few more species, but the most comprehensive work of this period was a revision of the entire New World Ophioninae by C. W. Hooker (1912). Hooker recognized nine genera as occurring in tropical America, but two of these (*Retanisia* and *Ophiopterus*) are currently placed in other ichneumonid subfamilies. Little further descriptive work was undertaken until 1947 when R. A. Cushman revised the generic classification of the Ophioninae. He recognized eight genera, *Thyreodon*, *Athyreodon*, *Rhynchophion*, *Ophion*, *Ophiogastrella*, *Agathophiona*, *Aulophion* and *Enicospilus* as occurring in tropical America. H. Townes (1971) produced a further generic reclassification of the Ophioninae and provided keys to the world genera, but these have now been rendered partially obsolete by the work of Gauld (1979; 1985). Gauld & Lanfranco (in press) have published a synopsis of the Latin American ophionine genera together with a new generic key.

At species-level, very little work has been done on the Mesoamerican ophionines after Hooker (1912) until Townes (1939) made some preliminary attempts at establishing synonymies. This work was continued in the important *Catalogue and Reclassification of Neotropic Ichneumonidae* (Townes & Townes, 1966). Except for work on *Thyreodon* by C. Porter (1984; 1986), there have been no recent attempts to produce keys to the diverse Mesoamerican ophionine species.

The Ophioninae

Diagnosis

Generally large (fore wing length usually 13+ mm) slender insects with a laterally compressed gaster, long antennae and legs, and ample wings. Labrum generally exposed; mandibles bidentate. Propodeal carinae occasionally complete though usually reduced, often with posterodorsal part of propodeum modified and coarsely sculptured. Fore wing with vein *2rs-m* absent, *3rs-m* present, joining *M* well distal to *2m-cu*; 1st subdiscal cell generally more sharply angled at base of *Cu*1a than it is at base of 1*m-cu*; 2nd subdiscal cell with a pigmented spurious vein extending from near end of 1*A* towards the hind corner of the wing; hind wing (of New World species) always with distal abscissa of *Cu*1 present. Tarsal claws pectinate. Gaster elongate; first segment more or less cylindrical anteriorly, with junction between tergite and sternite unrecognizable; spiracles positioned near to posterior end of tergite 1; glymmae not present; ovipositor (of New World species) short, not longer than apical abdominal depth, and usually with a dorsal subapical notch.

Field recognition

Most of the nocturnally active ophionines (i.e. most species in the subfamily) are large, yellowish brown insects with very slender antennae and large eyes and ocelli. They are very distinctive, but inexperienced workers may confuse them with other nocturnal ichneumonids that are superficially similar. No other nocturnal Central American hymenopteran has a fore wing with venation like that of an ophionine (Fig. 3); most others (*Cidaphus* and most *Netelia* species) have both veins 2*rs-m* and 3*rs-m* present, enclosing a small cell (the areolet) (Fig. 6), but rarely if only one vein is present it is 2*rs-m* and this joins *M* opposite to or proximal to 2*m-cu*. Other nocturnal ichneumonids often have a distinct glymma (a pit-like structure) present in tergite 1 and have the petiolar spiracles at or before the centre of the tergite.

The relatively few ophionine species that are diurnally active are predominantly black in colour with blackish or patterned wings. Although most are slender with strongly laterally compressed gasters, a few are quite stout and have short antennae. All these species may be distinguished from most other ichneumonids by the fore wing venation. Only a very few other ichneumonids have an ophionine-like venation, and these either have simple claws or entirely lack the distal abscissa of *Cu*1 in the hind wing.

Classification of the group

In early ichneumonid works (e.g. Morley, 1915) the name Ophioninae was applied to a large and heterogeneous group of ichneumonids with laterally compressed gasters. However, during the past 50 years this group has been subdivided into more natural taxa, and at present (Townes, 1971; Carlson, 1979; Gauld, 1985) the subfamily Ophioninae is restricted to include only those genera previously placed in the tribe Ophionini (e.g. sensu Hooker, 1912; Cushman, 1947; Townes, 1951). As currently recognized, the Ophioninae is one of the 31 subfamilies of the Ichneumonidae. Phylogenetically it is probably the sister-group of the Campopleginae (Gauld, 1985), and this pair of taxa belong to a lineage of endoparasitoids that includes the Banchinae, Ctenopelmatinae, Tersilochinae and Cremastinae

There have been three major classifications proposed for the genera of Ophioninae (Cushman, 1947; Townes, 1971; Gauld 1985). The first author recognized three groups of genera, the *Ophion*, *Thyreodon* and *Enicospilus* genus-groups. Townes (1971) subsequently amalgamated Cushman's *Thyreodon* and *Enicospilus* generic groups and recognized two tribes, the Ophionini (= the *Ophion* genus-group) and the Enicospilini (= the *Thyreodon* + *Enicospilus* genus-groups). Gauld (1985) pointed out that whilst Townes's Enicospilini was holophyletic, his Ophionini was a paraphyletic assemblage, and in an attempt to produce a more representatively phylogenetic classification Gauld divided the 32 world genera of Ophioninae into five holophyletic genus-groups, the *Ophion*, *Sicophion* and *Eremotylus* genus-groups (more or less corresponding to the Ophionini sensu Townes) and the *Thyreodon* and *Enicospilus* genus-groups (= Enicospilini of Townes). The large *Enicospilus* genus-group was further divided by Gauld into five subgroups, the *Orientospilus*, *Ophiogastrella*, *Stauropoctonus*, *Leptophion* and *Enicospilus* genus-subgroups.

The biology of Ophioninae

Natural history

Ophionines are solitary koinobiont endoparasitoids of the larvae of other holometabolous insects, that is they allow the host to develop for a period after oviposition (see also Askew & Shaw, 1986). A Nearctic species of *Ophion* is known to parasitize a coleopteran larva (Townes, 1971) and a European species has occasionally been recorded from a sawfly host (Thompson, 1957), but virtually all other rearings are from Lepidoptera. The most usual hosts are moth larvae that feed exposed on vegetation, especially species of the families Noctuidae, Lasiocampidae, Lymantriidae, Saturniidae, Geometridae, Arctiidae and Sphingidae. The larvae of Rhopalocera and Microlepidoptera are seldom attacked.

Samples of most ophionine species seem to comprise approximately equal numbers of both sexes, and rearing confirms a normal one to one sex ratio (Rohlfs & Mack, 1985*a*). Of 125 specimens of *Enicospilus lebophagus* reared at Santa Rosa National Park, Costa Rica in 1985, 71 were females and 54 males (D. H. Janzen, pers. comm.). This is not significantly different from a 1:1 sex ratio. Mating apparently occurs soon after emergence, but has not been observed. Most male ophionines have very uniform and unspecialized genitalia, though species of *Thyreodon* often have specifically different gonosquamae (Porter, 1984), and some species of *Ophiogastrella* and members of the *Enicospilus trilineatus* species-group have ornamented, flanged aedeagi. Species-characteristic secondary sexual features are observable in some species, though the functions of these various characters have never been investigated. Males of some *Enicospilus* species have species-specific arrangements of hair on the posterior gastral sternites, whilst the pubescence on the tarsi of males of some *Thyreodon* differs among species (Porter, 1984). The females of some species of *Ophiogastrella* have the distal segment of the fore tarsus modified and males of all species in this genus have flattened claws (see Fig. 15).

Adult ophionines occur in almost all habitats. Large numbers of species are crepuscular or strictly nocturnal (Rohlfs & Mack, 1985b). These insects are most frequently encountered at light, but sometimes they may be observed at dusk visiting flowers. Occasionally nocturnal species can be found roosting on the underside of leaves during the day. The diurnal ophionine species are more conspicuous and may often be encountered feeding from flowers or flying amongst shrub layer vegetation. Diurnally active koinobionts are probably exposed to a greater array of potential predators than are nocturnal species (Gauld, 1987), so it is not surprising to observe that many diurnal ophionines have protective devices. Some are aposematically coloured and resemble agressive aculeates. For example, *Rhynchophion flammipennis* is bluish black with orange, black-tipped wings and in flight looks extremely like some species of *Pepsis* (Pompilidae). Others, such as *Thyreodon* species, have elaborate flanges that guard the cervical membranes, and probably offer protection against asilid predators, whilst a few *Thyreodon* species have sharp processes on the mesoscutum which may serve to deter vertebrate predators.

Adult female ophionines are not known to feed on prospective hosts (Jervis & Kidd, 1986). All the females I have dissected (12 species) are apparently pro-ovigenic, that is they emerge from the pupa with a full complement of more or less mature eggs. Most individuals have between 7 and 30 mature eggs in each of their lateral oviducts. I have seen three individuals with one or no eggs present, suggesting further oocytes do not develop during active adult life. Rohlfs & Mack (1985*a*) observed that adult females of *Ophion flavidus* commenced oviposition within 24 hours of emerging from the pupa. Oviposition is into the host larva and is accomplished rapidly by the female straddling the host and thrusting her ovipositor forwards, into the host (Vickery, 1929). The ovipositor is withdrawn almost immediately. The ophionine egg is cylindrical, slightly curved and pale coloured. No sign of paralysis has been observed in newly parasitized hosts. Many ophionines oviposit into relatively mature larvae in their third or fourth (Vickery, 1929), or fourth or fifth instar (Moutia & Courtois, 1952; Rohlfs & Mack, 1985*a*), though some species attack young larvae (Price, 1975). Generally a single egg is deposited free in the haemocoel. No species of Ophioninae are known to develop gregariously. It is not known if ophionines inject viral particles or physiology-manipulating venoms into their hosts. However, they may do so since species of the closely related subfamily Campopleginae are well-known to do both (Vinson & Stoltz, 1986), as are species in other subfamilies in the lineage to which the Ophioninae belongs (Stoltz *et al.*, 1981) The ichneumonid egg hatches to produce a caudate first instar larva (Clausen, 1940) that lives in the haemocoelic cavity of the host (Moutia & Courtois, 1952). In most cases it is not known what effect parasitization has on the host caterpillar, although parasitized hosts are sometimes, but not necessarily, smaller than healthy ones. One species of *Ophion* has been shown to depress host-larval food consumption (Rohlfs & Mack, 1983).

An ophionine may have three or more larval instars, though this facet of their biology requires closer investigation as it is notoriously difficult to assess the number of instars that endoparasitoids undergo (Rojas-Rousse & Benoit, 1977). Post first instar ophionine larvae are hymenopteriform in appearance (Clausen, 1940). The ophionine larva usually does not kill its host until after the host larva is fully grown, and often after it has spun a cocoon or constructed some other form of pupation retreat. The fully grown parasitoid larva eats out all the body tissue and fluids of the host, leaving only the cephalic capsule and cuticle (Vickery, 1929 and pers. obs.). Generally the host is destroyed by the parasitoid final instar larva prior to actual pupation, and the parasitoid larva then spins a thick cocoon within the host cocoon or in the host's pupation chamber in the soil (Rohlfs & Mack, 1985*a*). One Palaearctic species of *Ophion* is unusual in that it spins a cocoon within the host pupa (Brock, 1982), whilst an American species of *Enicospilus* kills its host as a fully grown larva and spins a cocoon within the unbroken host larval skin (Hancock, 1926). Like many other Hymenoptera (Gauld & Bolton, 1988) ophionines apparently only have a brief pupal instar. A great deal of the period the ophionine spends within its cocoon may be passed as a final instar larva, and species which enter prolonged 'pupal' diapause probably do so as larvae. In north-western Europe one species of *Ophion* which emerges very early in spring passes the winter as a (?pharate) adult in the cocoon (Morley, 1915).

Host specificity

A great deal of work still needs to be undertaken on the host relationships of ophionines. It is very difficult to establish the real host range of any one species from the literature as misidentifications of both parasitoids and hosts abound. Host lists of the type compiled by Thompson (1957) can be misleading as they simply collect all records, but fail to re-evaluate the evidence upon which each is based (see also Askew & Shaw, 1986). All too often one finds that several congeneric sympatric species of ophionine are listed as having identical or very similar host ranges. For example, in the U.S.A. the two fairly common large ophionines *Enicospilus americanus* and *E. glabratus* were frequently confused in early literature, and they are both recorded from a similar range of saturniid, arctiid and lymantriid hosts (Hooker, 1912). Closer study has suggested that the former species only attacks saturniid larvae, whilst the latter is restricted to the larvae of arctiids and lymantriids (Gauld, 1988).

The evidence presently available indicates that there is a wide range of host specificity amongst species of Ophioninae. Many will attack a variety of hosts within a given family. The Central American species *Thyreodon atriventris* is believed to parasitize a range of sphingid larvae, but it has never been reared from similar-sized sympatric larvae belonging to other families (Janzen, pers. comm.). Other ophionines are more restricted in their host range, such as to hosts of a single subfamily; *Thyreodon santarosae* is only known to parasitize ceratocampine saturniids (Porter, 1986 and p. 61). Other species are believed to have an even more restricted host range and some apparently are monophagous. For example, *Enicospilus lebophagus* has only been reared from the saturniid *Rothschildia lebeau* despite intensive rearing of other sympatric possible hosts (Janzen, pers. comm.; Gauld 1988).

To view host range solely from a taxonomic viewpoint is undoubtedly a gross oversimplification, because a variety of other ecological parameters markedly affect host searching by parasitoids (see, Askew & Shaw, 1986; Lawton, 1986; Sato & Ohsaki, 1987). Different parasitoid species are often found in different types of habitat. For example, in Costa Rica *Thyreodon rivinae* and *T. maculipennis* may be quite common in deciduous Pacific dry forest, but they do not occur in neighbouring wet forests, where they seem to be replaced by other *Thyreodon* species. One of these exclusively wet forest species, *T. laticinctus*, is known to parasitize a species of sphingid that occurs in both wet and dry forest habitats (see p. 63), and thus this parasitoid only attacks its host over part of its host's geographical range. Innate responses to a combination of physical and semiochemical factors (Vinson, 1981; Weseloh, 1981; Elzen *et al.*, 1983) may lead a parasitoid to search for hosts in a very limited segment of the total environment, and within this limited niche a physically similar, or taxonomically related subset of the available species may be used as hosts. For example, *Enicospilus glabratus* parasitizes 'hairy' larvae (lymantriids and arctiids) that feed exposed on the leaves of angiosperm trees, whilst *E. purgatus* and *Ophion flavidus* have been reared from a variety of noctuid species that feed as larvae on low herbaceous vegetation. A number of Central American ophionines parasitize polyphagous hosts (e.g. see Janzen, 1984b) but it is not known whether larvae are parasitized equally on all possible foodplants. Studies on other endoparasitoids of lepidopterans indicate that the parasitoids develop with different degrees of success depending upon what food plant the host consumes (Barbosa *et al*. 1986; Thorpe & Barbosa, 1986).

Ophionine parasitoids of saturniids in North and Central America compared: a discrepancy in host ranges

As far as is known, virtually all members of one species-group of Ophioninae (the *Enicospilus americanus* complex) parasitize the larvae of saturniine and hemileucine saturniids. In eastern North America the host resource 'saturniid larvae' is divided between two polyphagous species, *E. americanus* which attacks a range of mostly saturniines, and *E. texanus* which parasitizes a variety of mostly hemileucine saturniids (Gauld, 1988). This situation is a good example of a phenomenon pointed out by Lawton (1986) – a sympatric, synchronous and phylogenetically closely related group of species share a parasitoid. However, in Mesoamerica the *E. americanus* complex is represented by 27 species that are known to, or considered likely to, attack saturniids (see pp. 123–172). A number of these have been reared, and in each case a single species of *Enicospilus* is only known to attack one species of saturniid. For example, *E. bozai* parasitizes *Copaxa moinieri*, *E. robertoi* parasitizes *Hylesia lineata*, *E. ugaldei* parasitizes *Automeris tridens* and *E. lebophagus* attacks *Rothschildia lebeau*. No saturniid is known to be attacked by more than one of these species of *Enicospilus*. These data suggest that in Mesoamerica the host resource 'saturniid larvae' has been subdivided by a host-species specific complex of *Enicospilus* and thus it seems that synchronous, sympatric and closely related tropical saturniids *do not* share parasitoids.

This is a surprising observation because, as host resources are more subdivided in tropical localities than temperate ones, one might expect tropical parasitoids to be more polyphagous than their temperate counterparts (see Janzen & Pond, 1975; Rathcke & Price, 1976). Janzen (1981) postulated an additional scenario in which he suggested that tropical koinobionts may be better at finding scarce hosts than their temperate relatives. Possibly, in the case of the *E. americanus* complex, evolutionary pressure for an increased ability to find rare hosts might have led to a narrowing of the 'searching image', resulting in a parasitoid only being able to locate a single host species, though it is difficult to imagine that such narrowing of the 'searching image' could alone lead to *E. lebophagus* only recognizing one of two very similar sympatric species of *Rothschildia* as a potential host. One might expect that natural selection would favour individuals that could attack either saturniid species.

However, insect larva are far from defenceless against koinobiont parasitoids. Many have well-developed immuno-defensive systems and are capable of encapsulating foreign bodies (such as developing parasitoids) in their haemocoel (Salt, 1975). Parasitoids overcome this defence in a variety of ways (Salt, 1968), especially by injecting substances during the oviposition sequence (Vinson & Iwantsch, 1980; Guzo & Stoltz, 1987). Clearly the potential exists for a co-evolutionary race between ophionine parasitoids and their saturniid hosts, with selective pressures favouring saturniid larvae with ever more efficient immuno-defensive systems and parasitoids that have more efficient immunosuppressive venoms. Such a mechanism could have led to the evolution of extreme host-specificity, thus permitting large numbers of closely related parasitoid species to exist sympatrically and synchronously. If immunosuppressive venoms are host-specific in this species-group, one would expect that even if *E. lebophagus* could be induced to oviposit in *Rothschildia erycina*, its progeny would be incapable of developing successfully.

One relevant question that potentially could be answered by systematics is, 'Did the host-specific tropical species arise from a northern generalist ancestor (of the *E. americanus* type), or have the North American generalists arisen from a more host-specific tropical species?' A thorough cladistic study of the *americanus* complex could reveal the answer, but preliminary work (Gauld, unpubl.) has not proved fruitful because few synapomorphies are recognizable and excessively high homoplasy plagues the data set. It is my subjective opinion that the entire species-complex may have had a northern origin, spreading to the New World from the Old. I suggest this because species very similar to *E. americanus* exist in widely separated parts of the Old World (e.g. *E. inflexus* and *E. undulatus* in the Palaearctic, *E. plicatus* and *E. grandis* in the Oriental region and *E. leucocotis* in southern Africa), and furthermore all the structurally more primitive members of the lineage exist in the Old World (e.g. the *E. cohacarus* species-complex in Madagascar). *E. americanus* is one of the structurally least specialized New World species, and it may well be similar to the ancestor of the diverse Central American species.

The Ophioninae of Mesoamerica

The composition and size of the Mesoamerican fauna

All of the genus-groups of Ophioninae recognized by Gauld (1985) are present in Central America, as are four of the five subgroups of the large *Enicospilus* genus-group (Table 1). The subfamily is represented in Mesoamerica by approximately 170 described species belonging to 12 genera, *Enicospilus*, *Ophion*, *Thyreodon*, *Ophiogastrella*, *Stauropoctonus*, *Rhynchophion*, *Sicophion*, *Prethophion*, *Janzophion*, *Simophion*, *Eremotylus* and *Agathophiona*. This is a greater generic diversity than that found in any other zoogeographical region except South America. Only two New World genera of Ophioninae are not represented in the study region,

Table 1 The higher classification of New World Ophioninae

OPHION genus-group
- *Ophion* Fabricius, 1798. [Widespread; also in Old World]
- *Alophophion* Cushman, 1947. [Temperate South America]
- *Agathiophiona* Westwood, 1882. [Sonoran Mexico]
- [Four other genera in Old World and Australia]

SICOPHION genus-group
- *Sicophion* Gauld, 1979. [Tropical Central and South America]
- *Janzophion* Gauld, 1985. [Tropical Central and South America] [One other genus in Australia]

EREMOTYLUS genus-group
- *Eremotylus* Foerster, 1869. [Widespread; also in Palaearctic]
- *Trophophion* Cushman, 1947. [SW. of U.S.A.] [One other genus in southern Palaearctic]

THYREODON genus-group
- *Rhynchophion* Enderlein, 1912. [Tropical America, southern U.S.A.]
- *Thyreodon* Brullé, 1846. [Widespread in New World] [Three other genera in Old World]

ENICOSPILUS genus-group
- *Orientospilus* subgroup
  - *Prethophion* Townes, 1971. [Tropical Central and South America]
  - *Simophion* Cushman, 1947. [Arid parts of Nearctic and Palaearctic regions; one possibly congeneric species from humid part of Panama]
  - [One other genus in Old World]
- *Ophiogastrella* subgroup
  - *Ophiogastrella* Brues, 1912. [Tropical Central and South America]
- *Stauropoctonus* subgroup
  - *Stauropoctonus* Brauns, 1889. [Tropical Central and South America; also in Old World and Australia]
  - [One other genus in Afrotropical region]
- *Leptophion* subgroup
  - [Three genera in Old World tropics and Australia]
- *Enicospilus* subgroup
  - *Enicospilus* Stephens, 1835. [Cosmopolitan]
  - [One other genus in Old World; three genera in Hawaii]

Alophophion, which is restricted to temperate southern South America, and *Trophophion*, which inhabits the arid areas of California and Arizona (Cushman, 1947; Gauld & Lanfranco, in press).

More than 60% of Mesoamerican species of Ophioninae, that is 116 species, belong to the genus *Enicospilus*. *Ophion* and *Thyreodon* are represented by about 20 species each, whilst the total of Mesoamerican species in all the other genera combined numbers only about 15.

Distribution patterns within Mesoamerica

It is an indisputable fact that all species of New World Ophioninae do not have the same geographical ranges, but what is perhaps more surprising is that neither do they all have totally different ranges. Rather one finds that a number of often only distantly related species have a very similar range and, for the group as a whole, there seems to be relatively few of these distribution patterns. The approximate limits of the nine preponderant ones are shown on Maps 2 and 3, and they are discussed further below.

1 Pan-American. Only four species of Ophioninae can be said to have a more or less Pan-American distribution, that is they are widely distributed from Canada or the northern United States southwards to Argentina. These four taxa, *Ophion flavidus*, *Enicospilus purgatus*, *E. dispilus* (= *arcuatus*) and *E. glabratus*, are generally common insects in disturbed habitats, but they are rather less common in pristine tropical forests. All seem to be fairly polyphagous, attacking a range of lepidopterous hosts, though they may be restricted to caterpillars in one vegetational stratum. *O. flavidus* and *E. purgatus* are parasitoids of grass- and herb-feeding noctuid larvae, *E. dispilus* is known to attack noctuids and notodontids that feed on shrubs or low trees, whilst *E. glabratus* seems to attack hairy larvae feeding on trees. The widspread temperate species *E. americanus* apparently does not have a Pan-American distribution as I have not found it to be present in tropical America; it seems to have a disjunct distribution, being present in temperate North America and southern South America.

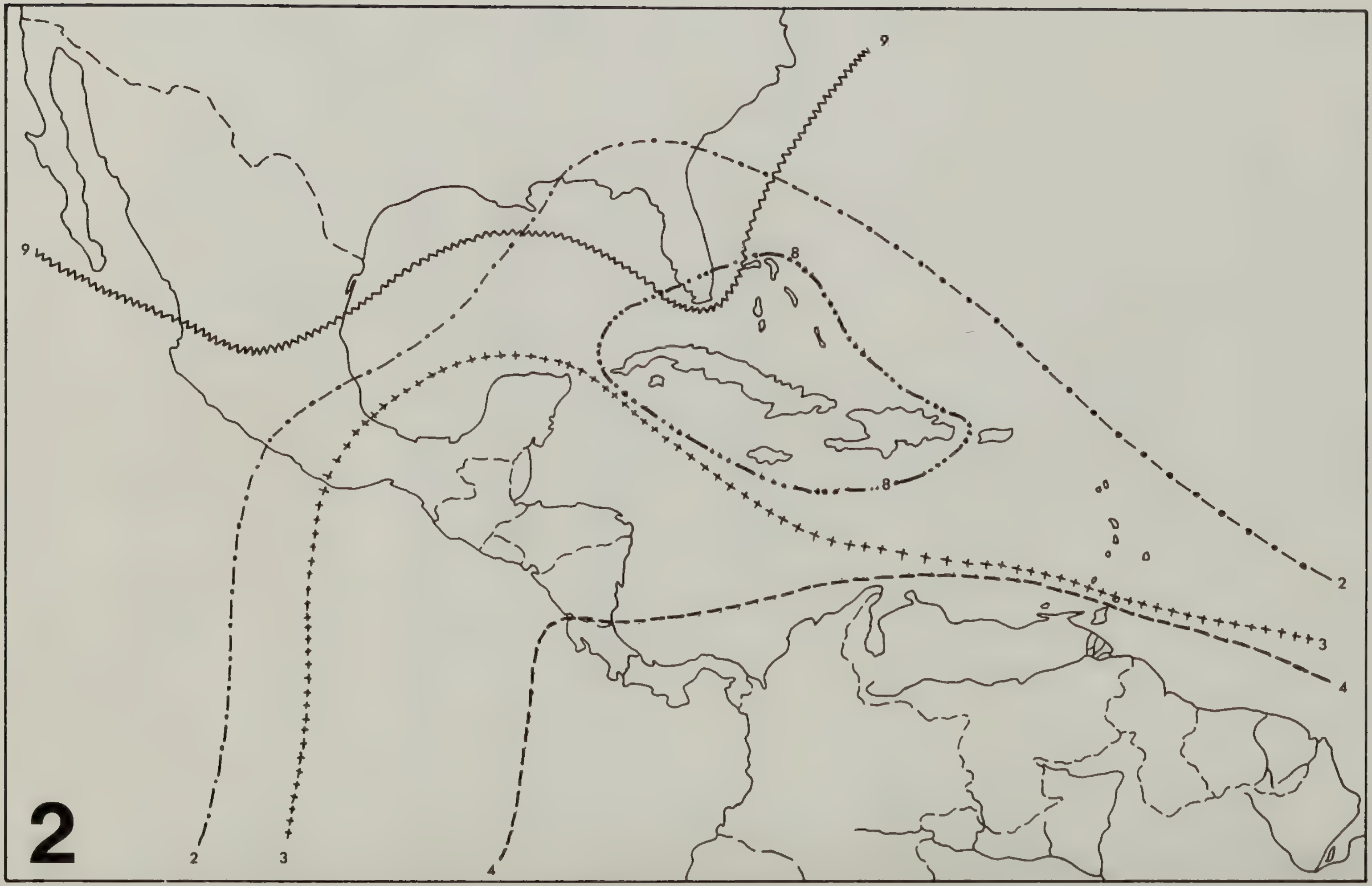
2 Tropical American. Several species are widespread throughout tropical South America, much of Central America, the Caribbean and into Florida. One of the commonest examples is *Enicospilus trilineatus* (= *appendiculatus*), though this is exceptional in extending quite widely into the southern United States. Other examples that have a more restricted range (generally only north to southern Florida) include *E. cubensis*, *E. fernaldi*, *E. flavus* and *E. guatemalensis*. A few other species, such as *Thyreodon atriventris*, *Enicospilus flavoscutellatus* and *E. liesneri*, have a very similar distribution, but are not yet known to occur in Florida. Conversely, a number of other taxa (including *E. aktites*, *E. ulfstrandi*, *E. orosii* and *E. opleri*) occur in Florida, Central America and South America, but they are not yet known from any Caribbean island. This apparent absence may simply reflect a paucity of collecting effort.

All of the species that are widespread throughout the smaller Caribbean islands either have type 1 or 2 distribution patterns; all widespread Caribbean species are also present in both Central and South America, though one, *E. flavus*, is only recorded from one Central American locality.

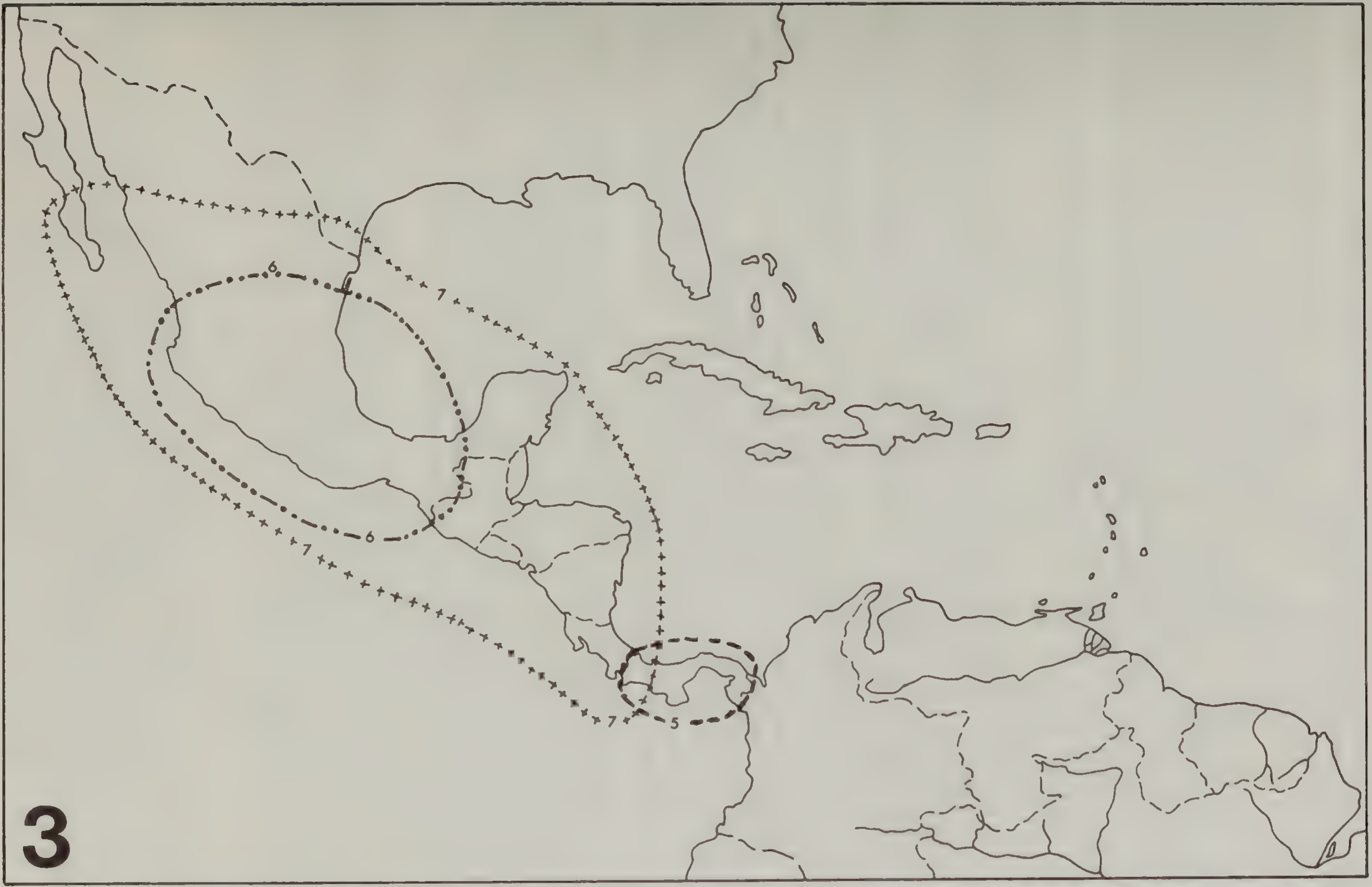
Most of the species showing a type 2 distribution pattern (e.g. *T. atriventris*, *E. cubensis*, *E. flavoscutellatus*) are rather catholic in their choice of habitat, and are found in disturbed dry forests as well as in relatively undisturbed wetter forest over a considerable altitudinal range. Others, like *E. aktites*, may have a preference for coastal scrub and woodland.

3 Mexican/Neotropical. A very large number of species of *Enicospilus* are widespread throughout tropical South and Central America, and extend as far north as the southern states of Mexico. They do not, however, occur on the Carribean islands or in Florida. Examples of taxa with this type of distribution include *Enicospilus monticola*, *E. mexicanus*, *E. columbianus*, *E. exoticus*, *Thyreodon morosus* and *T. laticinctus*. Virtually all of these species are more or less restricted to humid forest biomes.

4 Sub-Nicaraguan/Neotropical. A large number of ophionines are widespread throughout tropical South America, but their range only extends north into Panama or Costa Rica, reaching to about 11°N. Taxa with such a distribution include *Prethophion latus*, *Ophiogastrella maculithorax*, *Enicospilus chaconi*, *E. tenuigena*, *E. laurenae* and *E. xanthocarpus*. Several of these



Map 2 Mesoamerica showing approximate limits of distribution patterns; (2) northern limit of tropical American group; (3) northern limit of Mexican/Neotropical group; (4) northern limit of sub-Nicaraguan/Neotropical group; (8) Caribbean endemic group; (9) southern limit of temperate American group.



Map 3 Mesoamerica showing approximate limits of some distribution patterns; (5) Costa Rican/Panamania endemic group; (6) Mexican endemic group; (7) Central American endemic group.

species are associated with humid forest habitats at moderate altitudes (500-1000 m) on mountains, and the discontinuity of such habitats in the vicinity of Lake Nicaragua may have prevented them from spreading northwards.

5 Costa Rican/Panamanian. The existence of this area as a centre of endemicity may be artefactual as it is the most intensively sampled region. However, 13 species (*Ophion clio*, *O. uraniae*, *O. erato*, *O. flavoorbitalis*, *Janzophion nebosus*, *Sicophion fenestralis*, *Enicospilus georginae*, *E. martae*, *E. corcovadoi*, *E. erasi*, *E. bozai*, *E. mayi* and *Stauropoctonus bicarinatus*) are only known to occur in both Costa Rica and Panama. The first seven of these are taxa that only occur at moderate to very high elevation sites. In other regions a considerable degree of endemicity has been found amongst ophionines inhabiting montane areas (Gauld & Mitchell, 1978; 1981) so perhaps a similar group of endemic species is centred on that block of mountains dominated by the Cordillera Talamanca.

Seven taxa (*O. euterpe*, *O. arribai*, *Simophion melanostigma*, *Enicospilus karrensis*, *E. pamelae*, *E. fosteri* and *E. hubbelli*) are apparently restricted to Panama, whilst 27 taxa (Table 2) are endemic to Costa Rica.

6 Mexican. Twelve taxa (*Thyreodon ferrugineus*, *T. niger*, *T. robur*, *Agathophiona fulvicornis*, *Janzophion saxis*, *Eremotylus tropicus*, *Enicospilus halffteri*, *E. sarukhani*, *E. gomezpompai*, *E. dirzoi*, *E. catemacoi* and possibly *E. masoni*) are more or less endemic to Mexico. As I have not collected in Mexico, nor have I seen extensive collections from regions other than Chiapas, I can offer no further observations about any correlations between the distribution of ophionines and different major habitat types.

7 Central American. Several common species are widely distributed throughout Central America from Mexico or the extreme south of the United States, south to Costa Rica or Panama. Some of these taxa (e.g. *Thyreodon rivinae*, *T. maculipennis*, *T. apricus*, *Enicospilus lebophagus* and *E. ugaldei*) seem to be associated with areas which have a pronounced dry season. Such species may range as far north as the southern periphery of the United States, but they do not seem to occur further south than Guanacaste Province, Costa Rica. Other species (such as *E. donahuei*, *E. forsythei* and *E. parkeri*) are associated with wetter areas and only extend north to about the Tropic of Cancer, but they extend south into central Costa Rica or Panama.

8 Caribbean. Eleven species belonging to the genera *Enicospilus* and *Thyreodon* are endemic to islands in the Caribbean (Table 3). All, except the endemic Puerto Rican species *E. luquillo*, and *T. ultor*, which occurs both on Cuba and the Bahamas, are endemic to the large, geologically old islands of Cuba, Hispaniola and Jamaica. Seven of these taxa are restricted to just one of these islands, and only one, *E. howdenorum*, occurs on all three.

Some other species of *Enicospilus* have a similar, but slightly wider, distribution. For example, *E. sondrae* occurs in Florida as well as on the three major Caribbean islands, and *E. cressoni* also occurs in Florida and Mexico.

9 Temperate American. Although no serious attempt was made to study most of the ophionines that have this distribution, in passing I noted that *Enicospilus texanus* and several species belonging to the genera *Ophion* and *Eremotylus* have ranges that are predominantly in the United States, but extend southwards into northern Mexico (see Townes & Townes, 1966). Many of these taxa, such as *Ophion elongatus* and *Eremotylus subfuliginosus*, seem to be associated with semi-desert areas.

Comparison between the Mesoamerican fauna and that of South America

Many of the ophionine genera represented in Mesoamerica are more species-rich in South America. Some, such as *Ophiogastrella*, *Stauropoctonus* and *Sicophion*, have their northern limits in tropical Central America, whilst others, such as *Thyreodon* and *Enicospilus* seem to decrease in species-richness as one moves north.

Almost half of the species of *Enicospilus* present in Central America have either distribution patterns 2, 3 or 4, that is to say, they also occur widely in South America. Although the tropical South American fauna is incompletely known, an examination of the material available suggests

Table 2 Distribution of species of Ophioninae endemic to Costa Rica.

	Dry Forest		Wet Lower Montane Forest				Cloud forest	Montane Forest	
	Sta Rosa Nat. Park 330m	Cerro el Hacha 3–400 m	Braulio Carrillo 6–800m	Sn Ramón Reserve 8–900 m	Sn Gabriel district 8–900 m	Volcán Cacao 1100 m	Monteverde Reserve 13–1500 m	Volcán Poás 2350 m	Cerro de la Muerte 24–3200 m
Enicospilus									
abelardoi	−	−	+	+	−	−	−	−	−
alvaroi	+	−	−	−	+	−	−	−	−
brenesiae	−	−	−	−	−	−	+	−	−
ceciliae	−	+[2]	−	−	−	−	−	−	−
chaconi	−	−	+	−	−	−	−	−	−
estradrum	+	−	−	−	−	−	−	−	−
fogdenorum	−	−	−	−	−	−	+	−	−
gamezi	+	−	−	−	−	−	−	−	−
haberi	−	−	−	−	−	−	+	−	−
hemicrescellae	+	−	−	−	−	−	−	−	−
gabrieli	−	−	−	−	+	−	−	−	−
mengoi	−	−	+	−	−	+	−	−	−
oduberi	+	−	−	−	−	−	−	−	−
porteri	−	−	−	−	+[1]	−	−	−	−
vilmari	+	−	−	−	−	−	−	−	−
Ophiogastrella									
gonzalezi	+	+	−	−	−	−	−	−	
lemairei	+	−	−	−	−	−	−	−	
stilesi	+	−	−	−	−	−	−	−	
Ophion									
cacaoi	−	−	−	−	−	+	−	−	−
calliope	−	−	+	+	−	−	−	−	−
melpomene	−	−	−	−	−	−	−	+	−
polyhymniae	−	−	−	−	−	−	−	−	+
terpsichore	−	−	−	−	−	−	−	−	+
thaliae	−	−	−	−	−	−	−	−	+
Thyreodon									
santarosae	+	−	−	−	−	−	−	−	−
species 1	−	−	−	+	+	−	−	−	−

[1] Also occurs in similar habitat at Turrialba, 1000 m.
[2] Also occurs in similar habitat at Sta Cecilia, 400 m.
[N.B. *E. baltodanorum* is only known from Esquinas, Costa Rica.]

Table 3 Endemic species of Ophioninae in the Caribbean

	CUBA	HISPANIOLA	JAMAICA	PUERTO RICO	BAHAMAS
Enicospilus					
carlota	+	–	–	–	–
dajaboni	–	+	–	–	–
luquillo	–	–	–	+	–
howdenorum	+	+	+	–	–
masneri	–	+	–	–	–
Thyreodon					
affinis	+	–	–	–	–
elegans	+	–	–	–	–
flammiger	–	–	+	–	–
fulvescens	+	–	–	–	–
grandis	+	–	+	–	–
ultor	+	–	–	–	+

that more than 50% of this fauna is represented in Mesoamerica. Mesoamerica is thus faunistically very similar to South America.

Much of Mesoamerica is geologically recently subaerial (Coney, 1982), and to a considerable extent the flora and fauna of the region is thought to comprise recent colonists from the great continental masses of South and North America (Gentry, 1982; Rich & Rich, 1983). One is tempted to suggest that species exhibiting distribution patterns 2, 3 or 4 are recent colonists that have spread into Mesoamerica from the south, the most vagile having spread through the Caribbean to Florida, and less vagile species being restricted to the Central American mainland.

As one progresses north through Mesoamerica the Neotropical faunal element decreases, though it does not seem to do so smoothly. Rather, two 'steps' are apparent. The northernmost of these steps occurs about 20°N in southern Mexico; this is as far north as most Neotropical elements (such as *E. flavoscutellatus*, *E. monticola* and *E. mexicanus*) reach. Many other Neotropical species (e.g. *E. chaconi*, *E. tenuigena* and *E. xanthocarpus*, and species of other genera such as *Prethophion latus* and *Sicophion fenestralis*) have ranges that only extend to 10–11°N in Costa Rica so the second step more or less follows the Costa Rican/Nicaraguan border. Virtually every species that is known from Nicaragua, El Salvador, Honduras, Guatemala or Belize has a range that extends into southern Mexico. A similar stepped situation has been observed for the South American herpetofauna in Mesoamerica. Savage (1982) observed that 20 taxa had the northern limit of their range in Costa Rica, 11 had the northern limit of their range in Mexico, but only six had the northern limit of their range in the intervening area.

Comparison between the Mesoamerican fauna and that of North America

Comparatively few species are widespread in both North and Central America, and those that are (distribution pattern 1 species) are also widespread in South America. Amongst the Ophioninae there does not seem to be any north-centred homologue of patterns 2–4. The only aggregation of species with a north- centred distribution pattern (9) comprises a very small proportion of the Meosamerican fauna, and such elements do not penetrate into tropical areas.

Throughout much of North America *Ophion* is the dominant ophionine genus, far surpassing (both in numbers of species and individuals) all other ophionine genera combined. There are probably about 50 species of *Ophion* in North America (Gauld, 1985), and the genus becomes progressively less species-rich southwards throughout Central America. In tropical Mesoamerica most species of *Ophion* are restricted to cool localities at high altitudes.

Enicospilus is represented in North America by 22 species (Table 4). The majority of these taxa (13) only occur on the extreme southern fringes of the United States, in areas such as Florida south of 29°N, or Hidalgo county, Texas. Most of these species are also widespread in South America (i.e they have a type 2 distribution pattern). I know of only three species of *Enicospilus* with a north-centred distribution – *E. americanus*, whose range extends southwards

Table 4 Distribution of *Enicospilus* species in North America

	UNITED STATES				MESOAMERICA	
	Florida	Texas	California	Other states	Central America	Caribbean
aktites	+	–	–	–	+	–
americanus	+	+	+	+	+	–
cressoni	+	–	–	–	+	+
cubensis	+	–	–	+	+	+
cushmani	+	–	–	+	–	–
dispilus	+	+	+	+	+	+
doylei	+	–	–	+[1]	+	–
fernaldi	+	–	–	–	+	+
flavus	+	–	–	–	–[2]	+
glabrutus	+	+	+	+	+	+
guatemalensis	+	–	–	–	+	+
lebophagus	–	+	–	–	+	–
neotropicus	+	–	–	–	–	+
opleri	+	–	–	–	+	–
orosii	+	–	–	–	+	–
peigleri	+	–	–	+	+	–
purgatus	+	+	+	+	+	+
sarukhani	–	–	+	–	+	–
sondrae	+	–	–	–	–	+
texanus	+	+	+	+	–[3]	–
trilineatus	+	+	–	+	+	+
ulfstrandi	+	+	–	–	+	–

[1] single record from southern Louisiana.
[2] recorded once from Panama Canal.
[3] except for extreme north of Mexico.

through the Mexican uplands almost to the Guatemalan border (and has a disjunct representation in southern South America), *E. texanus*, whose range extends into northern Mexico, and *E. cushmani*, which is the only known endemic North American *Enicospilus*. Thus, to a large extent, the *Enicospilus* fauna of the United States can be regarded as a depauperate northern extension of the much richer Neotropical fauna.

The evolutionary history of Mesoamerican ophionines

The scenario suggested by the faunal elements – massive invasion of Mesoamerica from South America with some localized speciation – is probably a great oversimplification as certain species-groups which are most diverse in the Neotropics may initially have spread from the north and radiated in the south. For example, the *Enicospilus americanus* species-complex, the *E. purgatus* complex and the genus *Rhynchophion* all have their closest relatives in the Old World temperate regions, so possibly they colonized South America from the north and subsequently diversified in the tropics. Even *Stauropoctonus*, which is not now present in North America, may have spread to South America from North America at some remote time. This is suggested by the fact that the Neotropical species have obviously been derived from Old World taxa (and the group is unlikely to be old enough to predate the breakup of Gondwanaland) (see Gauld, 1985), and the most primitive Neotropical species of *Stauropoctonus* occurs at the northern extreme of the range of the genus in the New World (Fig. 82).

Possibly all species of *Enicospilus* in South America may have originated from a few ancestral colonists that spread through the north from the Old World. Although the phylogeny of *Enicospilus* is very incompletely understood, this scenario is suggested by the following facts:
a) the closest relatives of *Enicospilus*, that is *Dicamptus* and the *Leptophion* complex, are confined to the Old World;
b) *Enicospilus* is represented in the Old World by at least 30 very distinctive species-groups;

c) *Enicospilus* is represented in the New World by only five species-groups, two of which are more diverse in the Old World.
The great majority of tropical American *Enicospilus* species seem to comprise a single species-group, the *E. dispilus* group (see p. 75).

One group of species, the genus *Janzophion*, deserves special mention as it is endemic to mountain tops of Central America. Gauld (1985) hypothesized that this group and *Sicophion* represent ancient autochthonous South American relict groups that may have had a Gondwanic origin, as their closest relatives occur in Australia.

Latitudinal gradients in species-richness

Janzen (1981), analysing the distribution of species of seven ichneumonid subfamilies in North America (Acaenitinae, Banchinae, Diplazontinae, Metopiinae, Phygadeuontinae, Pimplinae and Xoridinae), found a general decrease in species-richness southwards from about 40°N. The Ophioninae, however, seems to be exceptional as it apparently shows an increasing species-richness towards the equator. Four American sites that have been reasonably well-collected are Washtenaw County, Michigan, U.S.A. (42°N), Alachua County, Florida, U.S.A. (29°N), the area around Huixtla, Chiapas, Mexico (17°N) and Guanacaste National Park, Costa Rica (11°N). Eleven species of Ophioninae have been found to occur at the Michigan site, 18 at the Floridan site, 49 in Chiapas and 69 in Guanacaste National Park. A similar latitudinal gradient was observed for the Ophioninae in Australia (Gauld, 1986), with tropical Queensland having more than twice as many species as temperate Tasmania.

Endemism in Costa Rica

In this study 28 species of Ophioninae have only been found to occur in Costa Rica (Table 2). Four of these (*Ophion polyhymniae*, *O. terpsichore*, *O. thaliae* and *O. melpomene*) are restricted to high altitude oak forest-dominated sites on the Cerro de la Muerte and Volcán Poás. Very similar vegetation is present at the same altitude in northern Panama, and many species (e.g. *Ophion uraniae*, *O. clio* and *Enicospilus georginae*) occur in this habitat in both countries. It would be quite surprising if the four apparently endemic Costa Rican *Ophion* species did not also occur in Panama. Similarly, *Ophion arribai*, only known from a high altitude oak forest in Chiriqui Province, Panama, may be expected to occur in similar habitats in Costa Rica. Political boundaries should not obscure the fact that it is the highland massif centred on the Cordillera de Talamanca which seems to be an area of endemism in Mesoamerica.

Eleven species (*Ophiogastrella gonzalezi*, *O. stilesi*, *O. lemairei*, *Thyreodon santarosae*, *Enicospilus gamezi*, *E. vilmari*, *E. estradarum*, *E. alvaroi*, *E. oduberi*, *E. hemicrescellae* and *E. ceciliae*) have only been found to occur either in, or in sites adjacent to, the Pacific dry forest of north-western Guanacaste. This is surprising as a similar endemicity has not been observed in their lepidopterous hosts. For example, Janzen (in press) has commented that the dry forest in Santa Rosa National Park, Guanacaste, has very few endemic species of Lepidoptera. Another surprising feature of these endemics is that, with the exception of one specimen of *E. alvaroi* which was collected in more humid forest in Rincón de la Vieja National Park (adjacent to drier areas), none has ever been collected in wet forest sites. This is remarkable because many other (non-endemic) dry forest species frequently occur in wet forest sites.

Eight species (*Ophion cacaoi*, *O. calliope*, *Enicospilus gabrieli*, *E. chaconi*, *E. abelardoi*, *E. mengoi*, *E. porteri* and *Thyreodon* species 1) occur in wet forests at altitudes between about 600 and 1100 metres. All but three of these species have been taken at more than one site. Three further species (*Enicospilus brenesiae*, *E. haberi* and *E. fogdenorum*) are only known to occur in cloud forests at altitudes between 1300 and 1500 metres. All of these species have only been collected in Monteverde reserve, and no Costa Rican endemics are known to occur both at Monteverde and any other site. The habitat of the remaining Costa Rican endemic species, *Enicospilus baltodanorum*, is unknown, but it may have been collected in lowland wet forest.

A comparison of tropical ophionine faunas in Mesoamerica and South East Asia

Although the species composition of the ophionine faunas of tropical Mesoamerica and South East Asia are completely different, there are interesting analogies and differences in the ophionine faunas of two areas. These are of some interest because the Ophioninae seems to be the dominant (= most species-rich) group of koinobiont ichneumonids in both areas

One of the most striking differences between the faunas of the two areas is the existence of a quite large group of diurnally active species (*Thyreodon* and *Rhynchophion*) in Mesoamerica, whilst only two very uncommon diurnal ophionine species (*Dictyonotus* spp.) are known to occur in South East Asia (Gauld & Mitchell, 1981). All three genera seem to be closely related, and are known to parasitize the larvae of sphingids, but ophionine sphingid parasitoids are more diverse and common in the New World than the Old.

Relatively few species of *Ophion* occur in either region, and the great majority of species that do are restricted to altitudes above 2000 metres.

Enicospilus is the most species-rich genus of ophionines in both tropical localities, yet the altitudinal distribution of the species differs strikingly between the regions. In the Central American states of Costa Rica and Panama the majority of *Enicospilus* species are encountered from altitudes ranging from sea-level to 1600 metres. Rather few species have been collected above 2000 metres and none at all have been taken above 3000 metres. In Borneo and New Guinea (which are typical examples of the South East Asian tropics) relatively few species of *Enicospilus* are encountered at low elevation sites and the greatest species-richness occurs between 1500 and 2500 metres. In New Guinea several species even occur above 3000 metres, though at this altitude species-richness is very low.

Table 5 presents a comparison of the *Enicospilus* species occurring in four well-collected Mesoamerican sites (Barro Colorado Island and Guadalupe Arriba in Panama, Santa Rosa National Park and Monteverde Reserve in Costa Rica) and four sites studied by the author at similar altitudes in Borneo and New Guinea. The lowland sites (<400 m) in Borneo are very much less species-rich than the cloud forest site (Gunong Pagon/Bukit Retak in Brunei), whilst in Mesoamerica the lowland sites are similar to or have a greater species-richness than the cloud forest site. Whilst lowland sites in South East Asia are less species-rich than upper montane forest sites (2300 m), the lowland sites in Mesoamerica are very much more species-rich than upper montane Mesoamerican sites.

In the Old World tropics, many species of *Enicospilus* have a much more restricted atitudinal range than their Mesoamerican congeners. For example, in Brunei 21 of the 34 species occurring between 1500 and 1700 metres did not occur at neighbouring low altitude sites (Gauld, 1986b), whilst not one of the 19 species collected at 2300 metres on Mt Kaindi, Papua New Guinea, has been collected at 1000 metres on the same mountain (Gauld & Mitchell, 1981). In Costa Rica 20 of the 38 species collected at Monteverde (1300–1400 m) also occur in Santa Rosa National Park (300 m) whilst all the species occurring at Guadalupe Arriba, Panama (2200 m) have also been collected at Monteverde (Costa Rica).

Table 5 Comparison of species-richness of *Enicospilus* at different altitudes in Central America and South East Asia

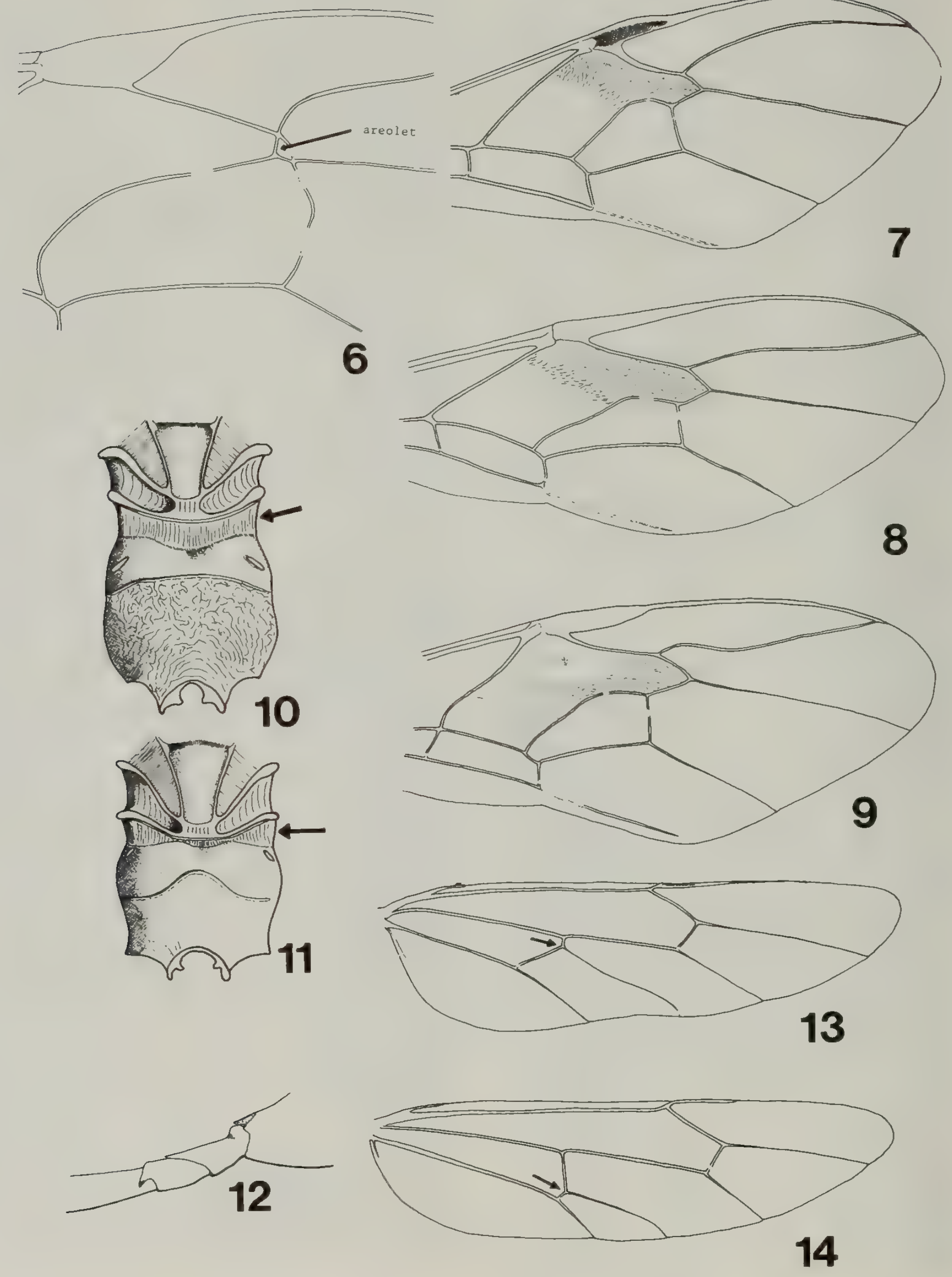
CENTRAL AMERICAN SITE	NO. SPP.	SOUTH EAST ASIAN SITE*	No. spp.
Barro Colorado Is., Panama, 150 m	38	Coastal Brunei, 0–100 m	8
Santa Rosa Nat. Pk, Costa Rica, 300 m	50	Brunei dipterocarp forest, 100–300 m	19
Monteverde Res., Costa Rica, 1300–1500 m	38	Pagon/Retak, Brunei, 1500–1700 m	34
Guadalupe Arriba, Panama, 2200 m	3	Mt Kaindi summit, Papua New Guinea, 2300 m	19

*sources Gauld & Mitchell, 1981; Gauld, 1986.

Nomenclatural summary

- ***OPHION*** Fabricius
  - ***arribai*** **sp. n.**
  - ***cacaoi*** **sp. n.**
  - ***calliope*** **sp. n.**
  - ***clio*** **sp. n.**
  - ***erato*** **sp. n.**
  - ***euterpe*** **sp. n.**
  - ***flavidus*** Brullé
    - *ancyloneura* Cameron
    - *biangularis* Taschenberg
    - *concolor* Szépligeti
    - *diversus* Szépligeti
    - *politior* Morley
  - ***flavoorbitalis*** Cameron
  - ***melpomene*** **sp. n.**
  - ***polyhymniae*** **sp. n.**
  - ***terpsichore*** **sp. n.**
  - ***thaliae*** **sp. n.**
  - ***uraniae*** **sp. n.**
- ***AGATHOPHIONA*** Westwood
  - ***fulvicornis*** Westwood
- ***SICOPHION*** Gauld
  - ***fenestralis*** **sp. n.**
- ***JANZOPHION*** Gauld
  - ***nebosus*** Gauld
  - ***saxis*** **sp. n.**
- ***EREMOTYLUS*** Foerster
  - ***tropicus*** **sp. n.**
- ***RHYNCHOPHION*** Enderlein
  - ***flammipennis*** (Ashmead)
- ***THYREODON*** Brullé
  - ***apricus*** Porter
  - ***atriventris*** (Cresson)
    - *grenadensis* Ashmead
    - *ornatus* (Szépligeti)
    - *rufothorax* Cameron
    - *thoracicus* (Ashmead)
  - ***erythrocera*** Cameron
  - ***laticinctus*** Cresson
  - ***maculipennis*** Cresson
  - ***morosus*** Smith
  - ***rivinae*** Porter
  - ***santarosae*** Porter
  - species 1
- ***PRETHOPHION*** Townes
  - ***latus*** Townes
- ***SIMOPHION*** Cushman
  - ***melanostigma*** (Cameron) **comb. n.**
- ***OPHIOGASTRELLA*** Brues
  - ***gonzalezi*** **sp. n.**
  - ***lemairei*** **sp. n.**
  - ***maculithorax*** Brues
  - ***stilesi*** **sp. n.**
- ***STAUROPOCTONUS*** Brauns
  - ***bicarinatus*** (Cushman)
- ***ENICOSPILUS*** Stephens
- ***undulatus*** species-group
  - ***abelardoi*** **sp. n.**
  - ***aktites*** Gauld
  - ***alvaroi*** **sp n.**
  - ***americanus*** (Christ)
    - *cecropiae* (Sanborn)
    - *druryi* (Kriechbaumer)
    - *rugosus* (Brullé)
  - ***bozai*** **sp. n.**
  - ***brevis*** (Morley)
  - ***cameronii*** (Dalla Torre)
    - *curvinervis* (Cameron)
    - *renovatus* (Morley)
  - ***chaconi*** **sp. n.**
  - ***chiriquensis*** (Cameron)
    - *calcator* (Morley) **syn. n.**
  - ***clarkorum*** **sp. n.**
  - ***cushmani*** Gauld
  - ***enigmus*** **sp. n.**
  - ***gamezi*** **sp. n.**
  - ***glabratus*** (Say)
    - *angulatus* (Hooker) **syn. n.**
    - *arctiae* (Ashmead)
    - *cubitalis* (Morley)
    - *excubitalis* Walkley
  - ***gomezpompai*** **sp. n.**
  - ***halffteri*** **sp. n.**
  - ***hallwachsae*** **sp. n.**
  - ***lebophagus*** Gauld
  - ***major*** (Morley)
  - ***mayi*** **sp. n.**
  - ***mexicanus*** (Cresson)
  - ***peigleri*** Gauld
  - ***quintanai*** **sp. n.**
  - ***robertoi*** **sp. n.**
  - ***sarukhani*** **sp. n.**
  - ***scuintlei*** **sp. n.**
  - ***tenuigena*** (Kriechbaumer)
  - ***texanus*** (Ashmead)
  - ***ugaldei*** **sp. n.**
  - ***umanai*** **sp. n.**
  - ***venezuelanus*** (Szépligeti)
- ***ramidulus*** species-group
  - ***doylei*** **sp. n.**
  - ***neotropicus*** Hooker
  - ***purgatus*** (Say)
    - *lateralis* (Brullé)
    - *flaviceps* (Brullé)
    - *volubilis* (Holmgren)
- ***trilineatus*** species-group
  - ***carlota*** **sp. n.**
  - ***cubensis*** (Norton)
  - ***dajaboni*** **sp. n.**
  - ***dirzoi*** **sp. n.**
  - ***lupemejia*** **sp. n.**
  - ***porteri*** **sp. n.**
  - ***trilineatus*** (Brullé)
    - *striatus* (Brullé)

sphacelatus (Erichson)
nigricauda (Taschenberg)
vecors (Tosquinet)
appendiculatum (Felt) **syn. n.**
brasiliensis (Szépligeti)
maculiceps Cameron
brevinervis (Morley) **syn. n.**
columbianus species-group
columbianus (Enderlein)
***martae* sp. n.**
dispilus species-group
***baltodanorum* sp. n.**
***barbarae* sp. n.**
***bima* sp. n.**
***brenesiae* sp. n.**
***burgosi* sp. n.**
***carri* sp. n.**
***catemacoi* sp. n.**
***ceciliae* sp. n.**
***cepillo* sp. n.**
***colini* sp. n.**
***corcovadoi* sp. n.**
***cornifuscus* nom. n.**
fuscicornis (Cameron)
cressoni Hooker
***devriesi* sp. n.**
dispilus (Szépligeti)
arcuatus (Felt) **syn. n.**
***donahuei* sp. n.**
***duckworthi* sp. n.**
***echeverri* sp. n.**
***erasi* sp. n.**
***estradarum* sp. n.**
exoticus (Morley)
bicolor (Szépligeti) **syn. n.**
dichromus Townes & Townes **syn. n.**
fernaldi Hooker
flavoscutellatus (Brullé)
thoracicus (Cresson)
trimaculatus (Taschenberg)
trispilus (Szépligeti) **syn. n.**
attritus (Enderlein) **syn. n.**
flavus (Fabricius)
flavarius (Thunberg)
concolor (Cresson)
guyanensis Cameron
***fogdenorum* sp. n.**
***forsythei* sp. n.**
***fosteri* sp. n.**
***gabrieli* sp. n.**
***galilea* sp. n.**
***gallegosi* sp. n.**
***georginae* sp. n.**
guatemalensis (Cameron)
***guindoni* sp. n.**
***haberi* sp. n.**
***hacha* sp. n.**
***hemicrescellae* sp. n.**
***howdenorum* sp. n.**
***hubbelli* sp. n.**
***jesicae* sp. n.**
***karrensis* sp. n.**
***kelloggae* sp. n.**
***kleini* sp. n.**
***lacsa* sp. n.**
***laurenae* sp. n.**
***leoni* sp. n.**
***liesneri* sp. n.**
***lovejoyi* sp n.**
***luisi* sp. n.**
***luquillo* sp. n.**
maculipennis (Cameron)
parvifasciatus Cameron **syn. n.**
***madrigalae* sp. n.**
***marini* sp. n.**
***maritzai* sp. n.**
***masneri* sp. n.**
***masoni* sp. n.**
***mengoi* sp. n.**
monticola (Cameron)
antomelas (Enderlein) **syn. n.**
elegans (Szépligeti) **syn. n.**
fuscipennis (Szépligeti) **syn. n.**
***oduberi* sp. n.**
***opleri* sp. n.**
***orosii* sp. n.**
***pamelae* sp. n.**
***parkeri* sp. n.**
persimilis (Szépligeti)
***pescadori* sp. n.**
***randalli* sp. n.**
***sanchezi* sp. n.**
***simoni* sp. n.**
***sondrae* sp. n.**
***stevensi* sp. n.**
***teodorae* sp. n.**
***ulfstrandi* sp. n.**
***vegai* sp. n.**
***vilmari* sp. n.**
***woldai* sp. n.**
xanthocarpus (Szépligeti)
flavosignatus (Enderlein) **syn. n.**
xanthostigma (Szépligeti)



Figs 6–14 6, central part of fore wing, *Netelia* sp. 7–9, fore wings; (7) *Janzophion nebosus*; (8) *Prethophion latus*; (9) *Sicophion fenestralis*. 10, 11, scutellum and propodeum, dorsal; (10) *Enicospilus* sp.; (11) *Ophiogastrella* sp. (arrows indicate anterior area of propodeum). 12, *Stauropoctonus* sp., hind trochantellar segments. 13, 14, hind wings; (13) *Sicophion fenestralis*; (14) *Enicospilus* sp. (arrows indicate junction of *Cu*1 and *cu-a*).

Key to genera occurring in Mesoamerica

1 Occipital carina dorsally entirely absent 2
– Occipital carina present, usually complete on upper part of head, but sometimes narrowly interrupted mediodorsally 4

2 Mid and hind trochantelli with distal margin produced into an acute, curved tooth (Fig. 12); mandibles twisted about 90° . . . . ***STAUROPOCTONUS*** (p. 72)
– Mid and hind trochantelli simple; mandibles not twisted, or twisted less than 20° 3

3 Fore wing with vein *Rs+2r* slender, almost straight; 2nd discal cell slender, longer than 1st subdiscal cell (Fig 8); epicnemial carina absent laterally. . . . . ***PRETHOPHION*** (p. 64)
– Fore wing with vein *Rs+2r* basally broadened, curved; 2nd discal cell stout, shorter than 1st subdiscal cell (Fig. 7); epicnemial carina present laterally. . . . . ***JANZOPHION*** (p. 49)

4 Labium with glossae greatly lengthened so as to form an elongate tube which reaches back to level of hind coxae (Fig. 18); female with subgenital plate greatly enlarged, longer than tergite 3
Blue-black Mexican insects . . . . ***AGATHOPHIONA*** (p. 48)
– Mouthparts not or only slightly lengthened, the glossae at most reaching to about the epicnemial carina (Figs 16, 17); subgenital plate of female usually not enlarged and shorter than tergite 3. 5

5 Hind wing with abscissa of *Cu*1 between *M* and *cu-a* at most 0.6 times as long as *cu-a*, generally shorter so junction of *Cu*1 and *cu-a* is close to *M* (Fig. 13) 6
– Hind wing with abscissa of *Cu*1 between *M* and *cu-a* at least 0.8 times as long as *cu-a*, generally longer so junction of *Cu*1 and *cu-a* is either intermediate between *M* and 1*A* (see Figs 45, 46), or is close to 1*A* (Fig. 14) 8

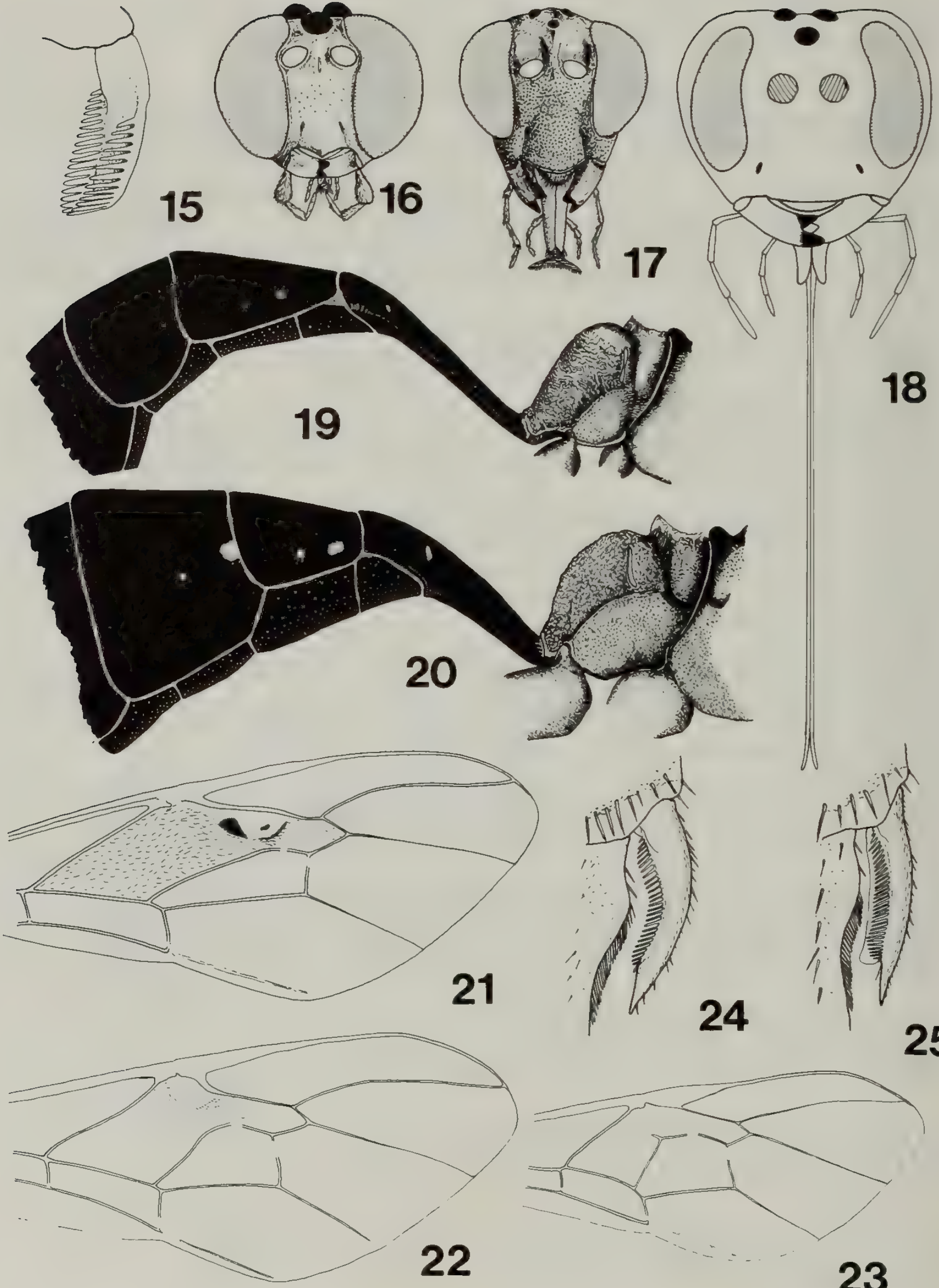
6 Fore wing with *Rs* centrally dipped (Fig. 9); pterostigma very broad; discosubmarginal cell anteriorly broadly glabrous . . . . ***SICOPHION*** (p. 51)
– Fore wing with *Rs* centrally almost straight; pterostigma very narrow; discosubmarginal cell with at most a small glabrous area anteriorly 7

7 Hind part of alitrunk, in profile, with propodeum greatly enlarged and metapleuron short and deep (Fig. 19); tergite 2 in profile long, generally longer than tergite 3, and with laterotergite pendant; mouthparts not particularly long, usually more or less concealed (Fig. 16). ***THYREODON*** (p. 54)
– Hind part of alitrunk, in profile, with propodeum not particularly enlarged, metapleuron longer than high (Fig 20); tergite 2 in profile much smaller than tergite 3, with laterotergite folded under; maxillae and labium elongate, projecting ventrally by a distance about equal to length of lower face (Fig. 17) . . . . ***RHYNCHOPHION*** (p. 53)

8 Fore wing with *Rs+2r* slightly sinuous, often thickened for more than half its length, and with a hairless fenestra in the discosubmarginal cell adjacent to it and extending about 0.5 of its length or more; fenestra often bearing pigmented sclerites in membrane (Fig. 21). ***ENICOSPILUS*** (most) (p. 74)
– Fore wing with *Rs+2r* straight or basally abruptly curved, slender or basally thickened; discosubmarginal cell only glabrous in anterior corner (Figs 22, 23), never with pigmented sclerite in wing membrane 9

9 Fore tibial spur, when viewed from behind, with a membranous flange along the comb (Fig. 25); tergite 2 usually with thyridia close to anterior end 10
– Fore tibial spur, when viewed from behind, without a membranous flange (Fig. 24); tergite 2 with thyridia separated from anterior margin by more than their own diameter 11

10 Fore wing with *Rs+2r* basally thickened and abruptly curved (Fig. 22); clypeus with margin flat, often blunt, never subapically impressed so margin is very thin; 1*m-cu* arcuate or sinuous, with at most a weak trace of a vein stub . . . . ***EREMOTYLUS*** (p. 52)
– Fore wing with *Rs+2r* at most slightly broadened basally, never abruptly curved (Fig. 23); clypeus with margin subapically impressed, thin; 1*m-cu* steeply curved or centrally elbowed usually with a long vein stub present. . . . . ***OPHION*** (p. 29)



Figs 15–25 15, *Ophiogastrella gonzalezi*, male hind tarsal claw. 16–18, head, front view; (16) *Thyreodon atriventris*; (17) *Rhynchophion flammipennis*; (18) *Agathophiona fulvicornis*. 19, 20, propodeum and anterior segments of gaster, lateral view; (19) *Thyreodon rivinae*; (20) *Rhynchophion flammipennis*. 21–23, fore wing; (21) *Enicospilus* sp.; (22) *Eremotylus tropicus*; (23) *Ophion flavidus*. 24, 25, fore tibial spur, seen from front; (24) *Enicospilus* sp.; (25) *Ophion* sp.

11 Mandible moderately to strongly tapered distally, generally twisted 15° or more (Figs 157, 158); posterior transverse carina of mesosternum usually present, rarely interrupted centrally; propodeum with anterior groove shallow and broad, so anterior surface is long (Fig. 10). **ENICOSPILUS** (few) (p. 74)

– Mandible weakly and evenly tapered distally, not twisted; posterior transverse carina of mesosternum absent except as lateral vestiges; propodeum with anterior groove short (Fig 11) 12

12 Epicnemial carina distinct laterally on mesopleuron; males with pectinal comb all round distal apices of flattened claws (Fig. 15)............................ **OPHIOGASTRELLA** (p. 66)

– Epicnemial carina only present as a trace medioventrally, laterally entirely absent; males with pectinal comb simple, not extending around distal apices of claws........ **SIMOPHION** (p. 65)

The *OPHION* genus-group

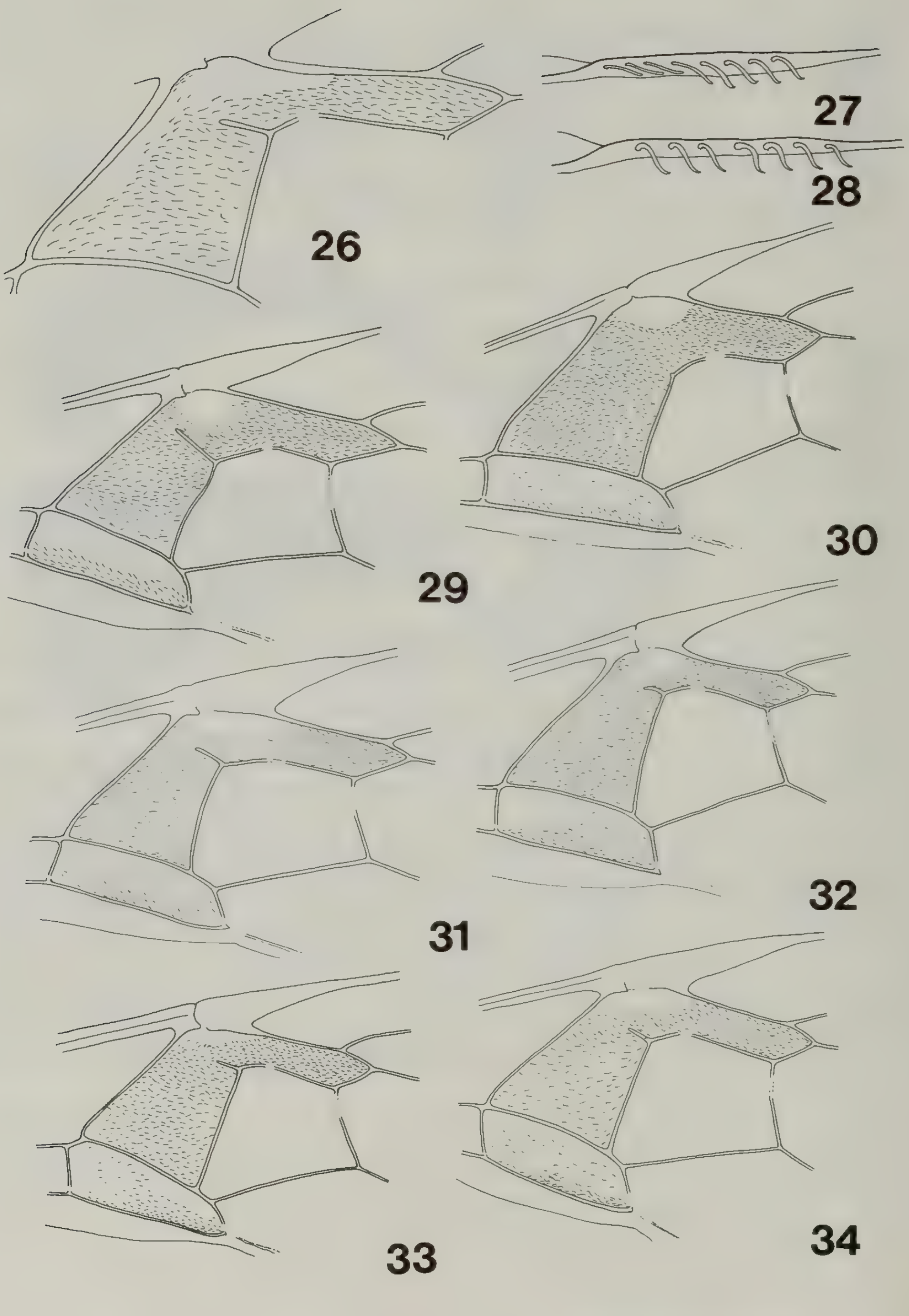
OPHION Fabricius

Ophion Fabricius, 1798: 210, 235. Type-species: *Ichneumon luteus* L., by subsequent designation, Curtis, 1836: 600.
Paniscus Schrank, 1802: 316. Type-species: *Ichneumon luteus* L., by monotypy.
[*Psylonychia* Szépligeti, 1905: 21. Nomen nudum.]
Stenophthalmus Szépligeti, 1905: 23. Type-species: *Stenophthalmus algiricus* Szépligeti, by subsequent designation, Viereck, 1914: 137. [Homonym of *Stenophthalmus* Becker, 1903.]
Pachyprotoma Kohl, 1906: 223. Type-species: *Ophion* (*Pachyprotoma*) *capitatus* Kohl, by monotypy.
Australophion Morley, 1912: 4, 30. Type-species: *Ophion peregrinus* Smith, by monotypy.
Neophion Morley, 1912: 4, 30. Type-species: *Neophion crassus* Morley, by subsequent designation, Viereck, 1914: 100.
Apatophion Shestakov, 1926: 262. Type-species: *Apatophion mirsa* Shestakov, by original designation.
Platophion Hellén, 1926: 13. Type-species: *Ophion areolaris* Brauns, by subsequent designation, Cushman, 1947: 475.
Potophion Cushman, 1947: 476. Type-species: *Potophion caudatus* Cushman, by original designation.
[*Psylonychia* Cushman, 1947: 476. Unavailable name, proposed in synonymy.]
Apomesus Townes, 1971: 54. Type-species: *Apomesus longiceps* Townes, by original designation.
Mecetron Townes, 1971: 60. Type-species: *Stenophthalmus choaspese* Uchida, by original designation.

DIAGNOSIS. Mainly orange or brownish yellow species with hyaline or slightly yellowish wings; fore wing length 10–27 mm. Mandibles stout, not twisted; maxillae and labium unspecialized; clypeus apically impressed, truncate to weakly convex; occipital carina complete (in Neotropical species). Notauli usually present anteriorly; mesopleural furrow curving upwards from episternal scrobe to subalar prominence; posterior transverse carina of mesosternum only represented by vestiges laterally. Fore wing with $Rs+2r$ more or less straight, not angled basally; discosubmarginal cell with a glabrous area in anterior corner; pterostigma moderately broad; 2nd discal cell large, with *1m-cu* rather angulate centrally and frequently with a well-developed vein stub; hind wing with first abscissa of *Rs* weakly to strongly bowed; distal abscissa of *Cu*1 variously positioned, but usually about equidistant between *M* and 1*A*. Fore tibial spur with a membranous flange behind comb. Gaster moderately slender; second segment of gaster with laterotergite folded under; tergite 2 longer than tergite 3.

REMARKS. *Ophion* is a large cosmopolitan genus that is most species-rich in the Holarctic realm. In the United States and in Mexico north of about 20°N *Ophion* species comprise a majority of the ophionine fauna, and a number of these species, such as *O. elongatus* Hooker, have ranges that extend southwards through the mountains into central and southern Mexico. It is not possible to work out these northern Central American species in isolation from the much richer Nearctic fauna, and such a study is beyond the scope of the present work. However, a number of *Ophion* species occur on the mountains in the southern part of Central America, and as this fauna seems to be distinct from the more northern fauna, a preliminary taxonomic treatment is presented below.

Townes & Townes (1966) list nine *Ophion* species as occurring in the Neotropical region, of which three, *O. flavidus* Brullé (= *ancyloneura* Cameron), *O. flavoorbitalis* Cameron and *O. melanostigma* Cameron, are recorded from Central America. I have examined the holotype of *O. melanostigma* and conclude that it is not a species of *Ophion* as it lacks a membranous flange on the fore tibial spur and has no umbo. These features suggest it belongs to the *Enicospilus* genus-group, and I have assigned it tentatively to the genus



Figs 26–34 *Ophion* species. 26, *O. calliope*, discosubmarginal cell. 27, 28, distal hamuli; (27) *O. arribai*; (28) *O. melpomene*. 29–34, central part of fore wing; (29) *O. erato*; (30) *O. cacaoi*; (31) *O. melpomene*; (32) *O. arribai*; (33) *O. flavoorbitalis*; (34) *O. thaliae*.

Simophion (see p. 65). I have found both of the remaining two species in southern Central America, together with 11 endemic new species which are described below.

In southern Central America the great majority of *Ophion* species are restricted to medium or very high altitude sites. Eight of the 13 species have only been collected above 2100 m, and one species is restricted to sites above 2700 m. Only four rather uncommon species have been collected in lowland or lower montane (1500 m or below) forested sites, and a single species, *O. flavidus*, is widely distributed and associated with disturbed habitats. At high altitudes *Ophion* species comprise a large proportion of the ophionine fauna. For example, the only ophionines known to occur above 3,000 m in Costa Rica are two *Ophion* species, whilst at Guadalupe Arriba (2200 m) in Panama, four of the nine ophionine species are *Ophion*.

Key to species of *Ophion* occurring in southern Mesoamerica

1 Discosubmarginal cell of fore wing narrowly glabrous adjacent to *Rs&M* (Fig. 26); propodeum with anterior transverse carina absent or present only as a central vestige, *and* with posterior transverse carina strong laterally, sometimes more or less complete 2

– Discosubmarginal cell of fore wing proximally fairly evenly hirsute, without a distinct glabrous band adjacent to *Rs&M* (Figs 29–34); propodeum often with both anterior and posterior transverse carinae strong, or with the anterior one stronger and more complete than the posterior one, or with no carinae really discernible 3

2 Head in dorsal view with genae strongly inflated behind eyes (Fig. 35); lower tooth of mandible slightly longer than the upper and slightly angled downwards (Fig. 38); tarsi only weakly depressed, the hind leg with the penultimate tarsal segment about 2.8 times as long as broad; flagellum yellowish brown; female with subgenital plate more or less unspecialized (Fig. 40) **euterpe** sp. n. (p. 34)

– Head in dorsal view with genae rounded behind eyes (Fig. 36); lower tooth of mandible slightly shorter than the upper, and not angled downwards (Fig. 37); tarsi very strongly depressed, ventrally flat, the hind leg with the penultimate tarsal segment about 1.4 times as long as apically broad; flagellum black; female with subgenital plate very large and plough-share shaped, projecting beyond apex of gaster (Fig. 39) .... **calliope** sp. n. (p. 35)

3 Head rather long, its width across the eyes 1.2 times length of head from vertex to clypeal apex (Fig. 42); hind leg with trochantellus dorsally longer than broad (Fig. 43); a predominantly blackish brown or very dark reddish brown species................ **polyhymniae** sp. n. (p. 36)

– Head short and broad with width across the eyes 1.3–1.5 times length of head from vertex to clypeal apex (Fig. 41); hind leg with trochantellus dorsally shorter than broad (Fig. 44); pale yellowish brown to brownish orange species.. 4

4 Hind wing with marginal cell proximally very long, with the junction of *Rs* and *rs-m* near centre so distal abscissa of *Rs* appears to be very short (Fig. 45).

A small pallid yellowish brown species frequently encountered in disturbed habitats below 1400 m.. ***flavidus*** Brullé (p. 37)

– Hind wing with marginal cell proximally short, with the junction of *Rs* and *rs-m* well proximal to centre so distal abscissa of *Rs* appears to be quite long (Fig. 46)........................ 5

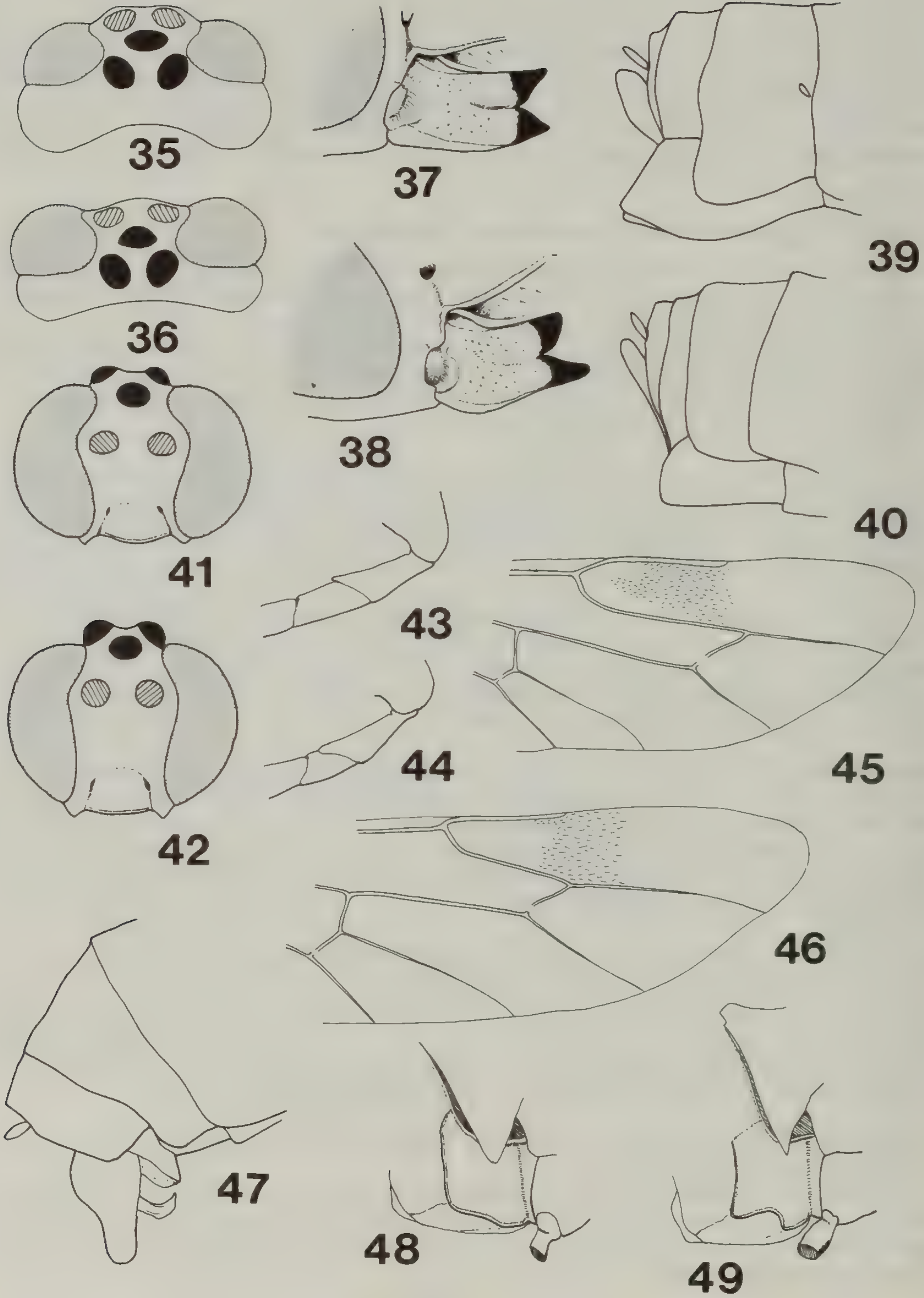
5 Very large insects, fore wing length 25+ mm; mid tibial spurs subequal in length, the longer 1.1–1.2 times length of the shorter.

Propodeum with posterior transverse carina close to anterior one so that area superomedia is subquadrate; marginal cell of hind wing proximally broadly glabrous...... **clio** sp. n. (p. 39)

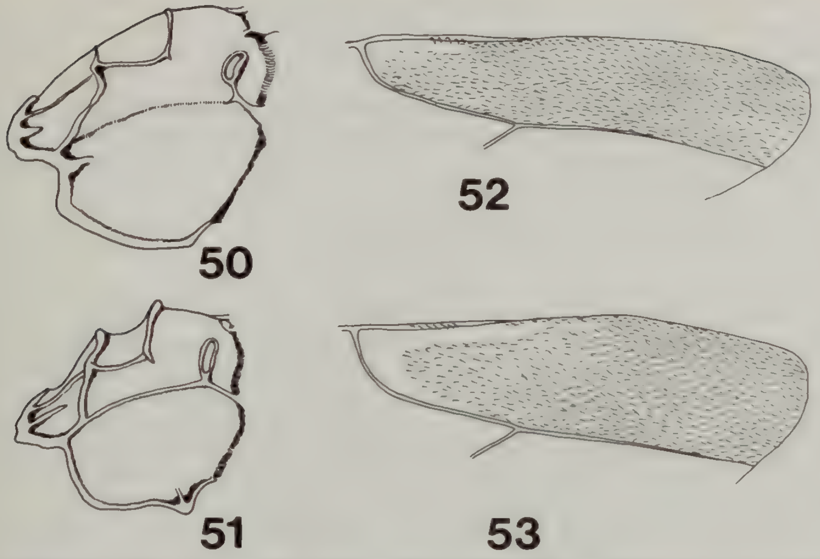
– Small to moderately large insects, fore wing length <24 mm; mid tibial spurs unequal, the longer 1.3–1.6 times length of the shorter 6

6 Posterior transverse carina of propodeum close to anterior one, with area superomedia more or less quadrate; fore wing with ramellus very short or absent (Fig. 30) *and* hind wing with marginal cell proximally almost uniformly hirsute .... **cacaoi** sp. n. (p. 40)

– Posterior transverse carina of propodeum well behind anterior one, so that area superomedia, if discernible, is much longer than broad; fore wing with ramellus moderately to very long (Figs 29, 31–34), if shorter than abscissa of *Cu*1 between 1*m-cu* and *Cu*1a then hind wing with marginal cell proximally glabrous in part (Fig. 53) 7



Figs 35–49 *Ophion* species. 35, 36, head, dorsal; (35) *O. euterpe*; (36) *O. calliope*. 37, 38, mandible; (37) *O. calliope*; (38) *O. euterpe*. 39, 40, posterior end of gaster of female, lateral view; (39) *O. calliope*; (40) *O. euterpe*. 41, 42, head, front view; (41) *O. flavidus*; (42) *O. polyhymniae*. 43–44, hind trochantellar segments; (43) *O. polyhymniae*; (44) *O. flavidus*. 45, 46, distal part of hind wing; (45) *O. flavidus*; (46) *O. thaliae*. 47, *O. uraniae*, posterior part of gaster of male, lateral view. 48, 49, epicnemium and lower part of anterior alitrunk, anterolateral view; (48) *O. flavoobitalis*; (49) *O. uraniae*.



Figs 50–53 *Ophion* species. 50, 51, propodeum, lateral view; (50) *O. thaliae*; (51) *O. flavoorbitalis*. 52, 53, marginal cell of hind wing; (52) *O. erato*; (53) *O. terpsichore*.

7 Lower corner of epicnemial carina, just lateral to a very strongly concave area, acute (Fig. 49); male with apex of aedeagus produced into a small acute protuberance (Fig. 47); mesopleuron reddish brown, with three pallid marks on upper part .... ***uraniae*** sp. n. (p. 41)

– Lower corner of epicnemial carina, just lateral to concave part, generally rounded, rarely angled at about 90° (Fig. 48); male with apex of aedeagus rounded; mesopleuron variously coloured, never dark reddish brown with three dorsal pale areas 8

8 Hind wing with proximal 0.3 of marginal cell densely hirsute centrally (Figs 52, 53)......... 9

– Hind wing with proximal 0.3 of marginal cell broadly glabrous, at most with isolated hairs centrally (Fig. 46) 12

9 Alitrunk laterally yellowish, with mesoscutum and mesosternum marked with dark brown; fore wing with ramellus very long (Fig. 29)... 10

– Alitrunk laterally orange or reddish brown, of similar colour to mesoscutum and mesosternum; fore wing with ramellus of moderate length (Figs 31, 32)............................ 11

10 Central flagellar segments slender, 2.1–2.3 times as long as broad; marginal cell of hind wing only glabrous along anterior margin (Fig. 52); mesopleuron highly polished, with indistinct microreticulation; gaster with anterior segments pale yellowish orange, segments 5+ infuscate... ***erato*** sp. n. (p. 43)

– Central flagellar stout, about 1.5 times as long as broad; marginal cell of hind wing glabrous all around proximal margin (Fig. 53); mesopleuron weakly polished, conspicuously granulate; gaster with anterior segments dark brown, the posterior segments brownish orange. ***terpsichore*** sp. n. (p. 44)

11 Fore wing with ICI = 0.40–0.44; CI>0.75; *Rs+2r* basally only slightly broadened, joining pterostigma well away from its base (Fig. 31); hind wing with all distal hamuli subtending similar angle to vein *R*1 (Fig. 28); scutellum reddish brown......... ***melpomene*** sp. n. (p. 44)

– Fore wing with ICI = 0.74–0.83; CI<0.60; *Rs+2r* basally abruptly thickened, joining pterostigma close to base (Fig. 32); hind wing with the most proximal 3 or more of the distal hamuli almost parallel to *R*1, subtending a far smaller angle than the most distal of the hamuli (Fig. 27); scutellum whitish .... ***arribai*** sp. n. (p. 45)

12 Fore wing with first subdiscal cell barely narrowed distally (Fig. 34); lateral longitudinal carina of propodeum only present as an anterior vestige, which is curved up to reach margin of propodeal spiracle (Fig. 50); hind wing with distal abscissa of *Cu*1 joining *cu-a* closer to 1*A* than to *M* .... ***thaliae*** sp. n. (p. 46)

– Fore wing with first subdiscal cell proximally very broad and strongly distally narrowed (Fig. 33); lateral carina of propodeum complete (Fig. 51); hind wing with distal abscissa of *Cu*1 joining *cu-a* closer to *M* than to 1*A* .... ***flavoorbitalis*** Cameron (p. 47)

Ophion euterpe sp. n.

(Figs 35, 38, 40)

Description. Mandibles stout, weakly narrowed apically, with upper tooth slightly broader and shorter than the lower tooth which is slightly bent downwards apically; outer mandibular surface coarsely punctate, with microreticulation between punctures, and with basal part of mandible broadly concave; distal segment of maxillary palp slender; malar space 0.2 times as long as basal mandibular width. Head in front view with greatest width across eyes 1.25 times length of head from vertex to clypeal margin; orbits ventrally slightly divergent; clypeus in profile weakly convex, with isolated punctures, apically with margin strongly impressed. Lower face centrally convex, polished and sparsely punctate. Head in dorsal view with genae grossly inflated behind eyes; posterior ocellus close to but not touching eye; occipital carina mediodorsally convex, ventrally weak but curved to join hypostomal carina well above base mandible. Antenna quite short and stout, with 50 flagellar segments; 20th segment 1.7 times as long as broad.

Mesoscutum polished and closely punctate, in profile abruptly rounded; notauli vestigial, only distinguishable as slight impressions near anterior end. Mesopleuron polished, centrally finely and quite closely punctate; lower corner of epicnemial carina sharply produced after concavity, and with upper end inclined towards anterior margin of pleuron, but evanescent. Scutellum in profile weakly convex, not laterally carinate. Metapleuron moderately convex, indistinctly punctate. Propodeum in profile abruptly rounded; anterior transverse carina present only as a central vestige, posterior transverse carina interrupted centrally, laterally quite strong; lateromedian longitudinal carinae vestigial; lateral longitudinal carina present anteriorly, joined to spiracular margin.

Fore wing length 14 mm; CI = 0.90; ICI = 0.54; SDI = 1.16; *cu-a* opposite to the base *Rs&M*; discosubmarginal cell very sparsely hirsute, with moderately large glabrous area anteriorly, and with a glabrous area along *Rs&M*; *Rs+2r* joining pterostigma near centre; 1st subdiscal cell sparsely hirsute; 1*m-cu* centrally angled, ramellus slightly shorter than abscissa of 1*m-cu* between its base and bulla. Hind wing with 8 hamuli on *R*1, the distal ones more tightly curved than the proximal ones; 1st abscissa of *Rs* proximally abruptly curved through about 50°; marginal cell proximally quite short, with junction between *Rs* and *M* proximal to centre, and with distal abscissa of *Rs* quite long; proximal 0.3 of marginal cell more or less glabrous with a few scattered hairs centrally; distal abscissa of *Cu*1 joining *cu-a* more or less intermediate between *M* and 1*A*.

Fore leg with tibia quite strongly with scattered spines on outer surface; fore tibial spur with an unusually fine microtrichial comb. Mid leg with longer tibial spur 1.5 times length of the shorter. Hind leg with coxa in profile 1.6 times as long as deep; trochantellus dorsally 0.2 times as long as broad; hind tarsus slender, the 4th segment 2.8 times as long as broad; claws of female long and weakly curved, with long pectinae.

Gaster stout; tergite 2 in profile 2.6 times as long as posteriorly deep; thyridia obovate and separated from anterior margin of tergite by about 0.5 times its own length. Female with subgenital plate long but unspecialized; ovipositor moderately long and straight, its sheath slender. Male unknown.

Colour generally orange; interocellar area yellowish orange; flagellum orange; pterostigma orange; wings distinctly yellowish.

Remarks. *Ophion euterpe* is immediately distinguishable from all other southern Mesoamerican species of *Ophion* by its grossly swollen temples. The stout gaster, enlarged subgenital plate, the proximally glabrous discosubmarginal cell, slightly flattened distal tarsal segments and weak anterior propodeal transverse carina are features found both in this species, and in an even more modified form, in *O. calliope* suggesting the two may be related

Biological Information. Only a single specimen of *O. euterpe* has been collected and it was taken at light in lowland rainforest on Barro Colorado Island, Panama. It is the only species of *Ophion* that has been collected in lowland rainforest. Nothing is known of the biology of this insect.

Material Examined

Holotype ♀, **Panama:** Barro Colorado Island, v.1978 (*Wolda*) (RNH).

Ophion calliope sp. n.

(Figs 26, 36, 37, 39)

DESCRIPTION. Mandibles stout, very weakly narrowed apically, with upper tooth similar to and about as long as the lower tooth; outer mandibular surface punctate, with microreticulation between punctures, and with basal part of mandible broadly concave; distal segment of maxillary palp slightly incrassate; malar space 0.1 times as long as basal mandibular width. Head in front view with greatest width across eyes 1.4 times length of head from vertex to clypeal margin; orbits ventrally slightly convergent; clypeus in profile weakly convex, with isolated punctures and with margin strongly impressed. Lower face centrally convex, polished and punctate. Head in dorsal view with genae rounded behind eyes; posterior ocellus contiguous with eye; occipital carina mediodorsally rather weak, convex, ventrally curved to join hypostomal carina almost at mandible. Antenna short and stout, with 47–51 flagellar segments; 20th segment 1.5–1.6 times as long as broad.

Mesoscutum polished and finely punctate, in profile abruptly rounded; notauli weakly impressed only near anterior end. Mesopleuron polished, centrally finely and quite sparsely punctate; lower corner of epicnemial carina bluntly rounded after concavity, and with upper end inclined towards anterior margin of pleuron, and joining it just above level of lower corner of pronotum. Scutellum in profile evenly convex, laterally carinate for 0.3–0.5 of its length. Metapleuron convex, finely punctate. Propodeum in profile abruptly rounded; anterior transverse carina indistinct, posterior transverse carina interrupted centrally, laterally strongly raised into crests; lateromedian longitudinal carinae weak in posterior part; lateral longitudinal carina absent, not joined to spiracular margin by a short carina.

Fore wing length 19–21 mm; CI = 0.65–0.70; ICI = 0.99–1.03; SDI = 1.19–1.30; *cu-a* more or less opposite to the base *Rs&M*; discosubmarginal cell sparsely hirsute, with moderately large glabrous area anteriorly and with narrow glabrous area along *Rs&M*; *Rs+2r* joining pterostigma close to base; 1st subdiscal cell sparsely hirsute; 1*m-cu* centrally angled, ramellus generally longer than abscissa of 1*m-cu* between its base and bulla. Hind wing with 9–10 hamuli on *R*1, the distal ones more tightly curved than the proximal ones; 1st abscissa of *Rs* proximally abruptly curved through about 70°; marginal cell proximally short, with junction between *Rs* and *M* far proximal to centre, and with distal abscissa of *Rs* long; proximal 0.3 of marginal cell with a central hirsute area; distal abscissa of *Cu*1 joining *cu-a* almost intermediate between *M* and 1*A*.

Fore leg with tibia slightly flattened, with numerous spines on outer surface. Mid leg with longer tibial spur 1.2–1.3 times length of the shorter. Hind leg with coxa in profile 1.6–2.0 times as long as deep; trochantellus dorsally 0.1–0.2 times as long as broad; all tarsi ventrally flattened, especially the distal two segments; hind tarsus with the 4th segment 1.3–1.5 times as long as broad; claws of female long and weakly curved, with long close pectinae, those of male similar but with pectinae finer and close together.

Gaster stout; tergite 2 in profile about 3 times as long as posteriorly deep; thyridia elliptical and separated from anterior margin of tergite by about 0.3–0.5 times its own length. Female with subgenital plate large, in profile plough-share shaped, ventrally convex and projecting beyond apex of gaster; posterior margin medially incised; ovipositor short and decurved, its apex slender; ovipositor sheath stout. Male with subgenital plate transverse, finely hirsute; gonosquama short, apically obliquely truncate and dorsally with a weak subapical notch; aedeagus simple, but with weak rounded lateral keels.

Colour uniformly orange-brown with mesoscutal vittae weakly infuscate, and head yellowish; interocellar area yellow; flagellum black, scape and pedicel orange; pterostigma orange; wings slightly yellowish.

REMARKS. This is one of the most distinctive American species of *Ophion* on account of the highly modified subgenital plate and the stout and strongly flattened distal tarsal segments. No other southern Mesoamerican species has a black flagellum like this insect. The relationships of *O. calliope* are not clear, but slightly modified tarsi and a slightly enlarged subgenital plate are found in *O. euterpe* and the two taxa may be related. This hypothesis of relationship is strengthened by the fact that both species also have a narrow glabrous band along the proximal periphery of the discosubmarginal cell, and have more or less lost the anterior transverse carina of the propodeum.

BIOLOGICAL INFORMATION. In Costa Rica *Ophion calliope* occurs in lower montane humid forests at altitudes between 700 and 1400 m. This is the only species of *Ophion* known to occur in intact forests at this altitude, though other species occur in disturbed areas at a similar altitude. Nothing is known of the biology of this insect though the form of the ovipositional apparatus suggests it might be attacking a young hairy or spined host. This is suggested by the fact that the subgenital plate forms a sort of shield that only allows the extreme apex of the ovipositor to project. The apex of the gaster is thus protected, and the ovipositor cannot penetrate far into the host.

MATERIAL EXAMINED

Holotype ♀, **Costa Rica:** Alajuela Prov.: San Ramón Reserve, Río San Lorencito, 800 m, xi.1986 (*Chacon*) (BMNH)

Paratypes. **Costa Rica:** Alajuela Prov.: 1 ♀, San Ramón Reserve, Río San Lorencito, 800 m, xi.1986 (*Chacon*) (BMNH); Puntarenas Prov.: 7 ♂, 13 ♀, Finca Las Cruces, 6 km S of San Vito de Java, 1400 m, x.1986 (*Eger*) (BMNH, CNC, MNCR, TC); San José Prov: 1 ♀, Braulio Carrillo National Park, Estacion Carrillo, 700 m, v.1985 (*Chacon*) (BMNH).

Ophion polyhymniae sp. n.

(Figs 42, 43)

DESCRIPTION. Mandibles stout, weakly narrowed apically, with upper tooth slightly broader and longer than the lower tooth, with distal edge slightly concave; outer mandibular surface coriaceous proximally, distally polished and sparsely punctate and with basal part of mandible with a small concave area; distal segment of maxillary palp slender; malar space 0.4–0.5 times as long as basal mandibular width. Head in front view with greatest width across eyes 1.1–1.2 times length of head from vertex to clypeal margin; orbits ventrally slightly convergent; clypeus in profile weakly convex, with weak isolated punctures, apically with margin strongly impressed. Lower face centrally weakly convex, weakly polished, with fine sparse punctures and with the area between them microreticulate/coriaceous. Head in dorsal view with genae rounded behind eyes; posterior ocellus separated from eye by about 0.1 times its maximum diameter; occipital carina mediodorsally arched upwards almost to a point, ventrally obsolescent, not clearly joining hypostomal carina. Antenna quite long and slender, with 51–55 flagellar segments; 20th segment 1.7–2.0 times as long as broad.

Mesoscutum polished, coriaceous, in profile evenly rounded; notauli vestigial, only distinguishable as slight impressions near anterior end. Mesopleuron polished, centrally finely and very closely punctate; lower corner of epicnemial carina about a right angle after broad concavity, and with upper end inclined towards anterior margin of pleuron, which it reaches just above level of lower corner of pronotum. Scutellum in profile fairly weakly convex, not laterally carinate. Metapleuron weakly convex, finely punctate, with intervening area coriaceous. Propodeum in profile evenly rounded; anterior transverse carina complete, posterior transverse carina broadly incomplete centrally, laterally quite strong; lateromedian longitudinal carinae absent; lateral longitudinal carina present anteriorly, joined to spiracular margin.

Fore wing length 17–19 mm; CI = 0.50–0.57; ICI = 0.51–0.62; SDI = 1.17–1.20; *cu-a* subopposite to the base *Rs&M*; discosubmarginal cell evenly hirsute, with moderately large glabrous area anteriorly, and without a glabrous area along *Rs&M*; *Rs+2r* joining pterostigma close to centre; 1st subdiscal cell fairly evenly hirsute; 1*m-cu* centrally angled, ramellus distinctly shorter than abscissa of 1*m-cu* between its base and bulla. Hind wing with 9–11 hamuli on *R*1, the distal ones more tightly curved than the proximal ones; 1st abscissa of *Rs* proximally abruptly curved through about 60°; marginal cell proximally short, with junction between *Rs* and *M* far proximal to centre, and with distal abscissa of *Rs* long; proximal 0.3 of marginal cell glabrous peripherally but centrally hirsute; distal abscissa of *Cu*1 usually joining *cu-a* closer to 1*A* than to *M*, but sometimes intermediate between the veins.

Fore leg with tibia subcylindrical without obvious spines on outer surface. Mid leg with longer tibial spur 1.4 times length of the shorter. Hind leg with coxa in profile 2.0–2.1 times as long as deep; trochantellus dorsally 1.0–1.1 times as long as broad; hind tarsus slender, the 4th segment 2.3–2.7 times as long as broad; claws of female long and weakly curved, with long pectinae, those of male similar but with pectinae slightly shorter and closer together.

Gaster slender; tergite 2 in profile more than 4 times as long as posteriorly deep; thyridia elliptical and separated from anterior margin of tergite by about 0.5 times its own length. Female with subgenital plate moderately long, unspecialized; ovipositor moderately long, straight and apically slender, its sheath slender. Male with subgenital plate transverse, unspecialized; apex of aedeagus rounded.

Colour generally blackish brown or dark reddish brown, orbits and sometimes vertex indistinctly suffused with whitish yellow; flagellum orange brown, proximally infuscate; mesepimeron orange-brown; legs reddish brown; flagellum orange; pterostigma orange-brown; wings slightly infumate.

VARIATION. There is some variation in propodeal carination, and although most individuals have the anterior transverse carina complete it may be weak or even virtually absent in some specimens. Many other *Ophion* species show great variation in propodeal carination and the range of variation exhibited here is not considered exceptional

REMARKS. *Ophion polyhymniae* is immediately distinguishable from all other southern Mesoamerican species of *Ophion* by its dark coloration, its rather elongate head and wide malar space. The rather fine microreticulate sculpture observable over much of the alitrunk of *O. polyhymniae* is also found in *O. melpomene*. However, on the basis of this character I hesitate to suggest that these two species are closely related because similar sculpture is present on species from high altitudes in other regions, including the Himalayas and New Guinea. This suggests that this sculptural character may, in some way be an adaptation to high altitude existence, and perhaps a poor indicator of phylogenetic affinity

BIOLOGICAL INFORMATION. *Ophion polyhymniae* occurs in montane habitats on the Cerro de la Muerte in Costa Rica where individuals have been collected quite frequently (considering how often the habitat has been sampled) between March and June in *Quercus* forests at altitudes of 2700–3200 m. *O. polyhymniae* flies at dusk and in the early part of the night; after about 2100 h individuals seem to be very lethargic. The hosts of this insect are not known.

MATERIAL EXAMINED

Holotype ♂, **Costa Rica:** Cartago Prov.: Cerro de la Muerte, 1 km NE. Cerro Asuncion, 3100 m, iii. 1985 (*Janzen & Hallwachs*) (BMNH)

Paratypes. **Costa Rica:** Cartago Prov: 1 ♂, Cerro de la Muerte, 2700 m, vi.1986 (*Gauld*) (BMNH); San José Prov.: 3 ♂, Cerro de la Muerte, 2 km E. Cerro Asuncion, 3140 m, iv.1984 (*Janzen, Hallwachs & Gauld*) (BMNH); 1 ♂, 2 ♀, Cerro de la Muerte, 3200 m, iii-iv.1985 (*Masner & Goulet*) (CNC).

Ophion flavidus Brullé

(Figs 23, 41, 44, 45)

Ophion flavidus Brullé, 1846 : 143. Lectotype ♀, BRAZIL (MNHN), designated by Townes & Townes (1966: 168) [examined].

Ophion biangularis Taschenberg, 1875: 432. Holotype ♀, BRAZIL (Halle). [Synonymized by Townes & Townes, 1966: 168.]

Ophion ancyloneura Cameron, 1886: 294. Holotype ♀, GUATEMALA (BMNH) [examined]. [Synonymized by Townes & Townes, 1966: 168.]

Ophion diversus Szépligeti, 1906: 131. Lectotype ♀, PARAGUAY (TM), designated by Townes & Townes (1966: 168) [Synonymized by Townes & Townes, 1966: 168.]

Ophion concolor Szépligeti, 1906: 132. Lectotype ♂, ARGENTINA (TM), designated by Townes & Townes (1966: 169) [Synonymized by Townes & Townes, 1966: 169.]

Ophion politior Morley, 1912: 56. Lectotype ♀, BRAZIL (BMNH), designated by Townes & Townes (1966: 169) [examined]. [Synonymized by Townes & Townes, 1966: 169.]

DESCRIPTION. Mandibles moderately stout, weakly narrowed apically, more or less equally bidentate; outer mandibular surface punctate, coriaceous between punctures, and with basal part of mandible broadly concave; distal segment of maxillary palp slender; malar space 0.1 times as long as basal mandibular width. Head in front view with greatest width across eyes 1.3–1.4 times length of head from vertex to clypeal margin; orbits ventrally slightly convergent; clypeus in profile rather weakly convex, with isolated punctures with margin quite strongly impressed. Lower face centrally weakly convex, polished and quite densely punctate. Head in dorsal view with genae rounded behind eyes; posterior ocellus very close to but not contiguous with eye; occipital carina mediodorsally convex, ventrally curved to join hypostomal carina well above base mandible. Antenna quite long and stout, with 53–59 flagellar segments; 20th segment 1.7–1.6 times as long as broad.

Mesoscutum polished, finely punctate, in profile evenly rounded; notauli fairly weakly impressed near anterior end, but readily discernible as rugose area. Mesopleuron polished, centrally usually closely punctate, sometimes with traces of microreticulation present between punctures, rarely with punctures small and intervening area smooth and highly polished; lower corner of epicnemial carina bluntly rounded after concavity, and with upper end inclined towards anterior margin of pleuron, which it generally reaches just above lower corner of pronotum. Scutellum in profile weakly convex, laterally carinate on anterior 0.1–0.3. Metapleuron quite strongly convex, punctate. Propodeum in profile abruptly rounded; anterior transverse carina almost invariably complete, posterior transverse carina complete or centrally obsolescent; lateromedian longitudinal carinae generally strong and reaching to anterior transverse carina, thus enclosing distinct areae superomedia and petiolaris, or weaker and only enclosing the area petiolaris; lateral longitudinal carina complete, joined to spiracular margin.

Fore wing length 10–14 mm; CI = 0.44–0.60; ICI = 0.50–0.63; SDI = 1.15–1.29; *cu-a* more or less opposite to the base *Rs&M*; discosubmarginal cell sparsely hirsute, with moderately large glabrous area anteriorly, without a glabrous area along *Rs&M*; *Rs+2r* joining pterostigma close to centre; 1st subdiscal cell sparsely hirsute; *1m-cu* centrally angled, ramellus shorter than abscissa of *1m-cu* between its base and bulla. Hind wing with 5–8 hamuli on *R*1, the distal ones more tightly curved than the proximal ones; 1st abscissa of *Rs* proximally abruptly curved through about 85°; marginal cell proximally long, with junction between *Rs* and *M* near to centre, and with distal abscissa of *Rs* quite short; proximal 0.3 of marginal cell centrally closely hirsute, periphery glabrous; distal abscissa of *Cu*1 joining *cu-a* very much closer to 1*A* than to *M*.

Fore leg with tibia subcylindrical, with isolated spines on outer surface. Mid leg with longer tibial spur 1.4–1.5 times length of the shorter. Hind leg with coxa in profile 1.8–2.0 times as long as deep; trochantellus dorsally 0.4–0.6 times as long as broad; hind tarsus slender, the 4th segment 2.6–2.9 times as long as broad; claws of female long and weakly curved, with long close pectinae; claws of male similar but with pectinae shorter and closer together.

Gaster quite slender; tergite 2 in profile about 4 times as long as posteriorly deep; thyridia elliptical and separated from anterior margin of tergite by about 0.5 times its own length. Female with subgenital plate large, unspecialized, triangular in profile; ovipositor moderately long, straight and slender, its sheath slender. Male with subgenital plate transverse, unspecialized; aedeagus apically slender, rather abruptly angled

Colour generally pallid yellowish; interocellar area yellow; flagellum orange; pterostigma orange; wings very slightly yellowish.

VARIATION. The most obvious variation occurs in the extent of the propodeal carination. Generally the anterior and posterior transverse carinae are very strong and usually the anterior one is laterally abruptly curved back to join the posterior one; the lateromedian longitudinal carinae are generally complete to the anterior carina so the areae petiolaris, superomedia and dentipara are delineated. However, any or all of these carinae may be weak or indistinct (though the anterior one is never absent if the posterior one is present), so at the most extreme no areae are enclosed. Although most specimens are pallid in colour, isolated individuals may be darker brownish orange and I have seen one individual which has dark mesoscutal vittae.

REMARKS. *Ophion flavidus* can be most easily recognized by the proximally elongated marginal cell in the hind wing. No other Mesoamerican species has this cell so lengthened. The rather pallid colour of most specimens is also quite distinctive as most other *Ophion* species are darker reddish brown

BIOLOGICAL INFORMATION. *Ophion flavidus* is one of the commonest and most widely distributed American species of Ophioninae. It has been recorded from New York State south to Florida and Texas and west to Kansas in the United States (Carlson, 1979), and it occurs throughout the Caribbean (Wolcott, 1923; Gowdey, 1926) and Latin America south to Argentina (Costa Lima, 1962; Townes & Townes, 1966; de Santis & Esquivel, 1966). In Central America it is frequently encountered in the drier lowlands on the Pacific side of the continent, and *O. flavidus* is the only species of *Ophion* known to occur in Santa Rosa National Park, Costa Rica, where it is quite common at the start of the wet season. The cumulative seasonal data (lights and malaise traps) for 1984–6 are:

J	F	M	A	M	J	J	A	S	O	N	D
–	–	1	–	5	25	7	4	3	6	–	-

O. flavidus also seems to occur commonly in agricultural and even suburban areas at higher elevations up to about 1300 m, such as at Monteverde or San Antonio de Escazú in Costa Rica. At the former site this species appears to be less seasonal than it does in the lowlands and I have seen isolated specimens collected during all months of the year. A large number of individuals were found in association with the grass-eating noctuid *Mocis repanda* (F.) on Volcán Cacao, though none was actually reared.

I have also seen a number of individuals from higher altitudes, such as Guadalupe Arriba in Panama (2200 m), but I have only seen a single specimen that has been collected above 2400 m. At Guadalupe Arriba *O. flavidus* is comparatively rarely collected and the cumulative seasonal data from two years' collecting with a light trap are:

J	F	M	A	M	J	J	A	S	O	N	D
3	–	–	1	–	1	1	1	5	2	–	2

O. flavidus is a common endoparasitoid of the larvae of a variety of species of Noctuidae that feed on herbaceous vegetation in disturbed and agricultural habitats and include some notorious pests. It is thus an economically important insect. For example, in Alabama, *O. flavidus* is one of the most common larval parasitoids of the Fall Armyworm, *Spodoptera frugiperda* (Smith), and investigations are currently being undertaken with a view to maximizing its potential for biological control purposes (Rohlfs & Mack, 1985*b*). There are also reliable records of this species parasitizing *Agrotis ipsilon* (Hufnagel), *Heliothis zea*

(Boddie), *Peridroma saucia* (Hübner), *Pseudaletia unipuncta* (Haworth) and *Spodoptera eridania* (Cramer) (Costa Lima, 1962; Carlson, 1979). The biology of *O. flavidus* has recently been studied by Rohlfs & Mack (1983; 1985*a* & *b*), and the details given by Vickery (1927) about *O. bilineatus* Say may actually refer to this species.

MATERIAL EXAMINED

Lectotype ♀ (*Ophion flavidus* Brullé), **Brazil:** 'Ouest' (MNHN). Holotype ♀ (*Ophion ancyloneura* Cameron) **Guatemala:** Capetillo (BMNH). Lectotype ♀ (*Ophion politior*), **Brazil:** Rio Grande (BMNH); paralectotypes 2 ♀, same locality as lectotype.

Costa Rica: Alajuela Prov.: 1 ♀, Finca San Gabriel, 3 km W. Dos Ríos, 850 m, vi.1986 (*Gauld*) (BMNH); 1 ♀, 8.2 km N Vara Blanca, iv.1984 (*Janzen & Hallwachs*) (BMNH); Guanacaste Prov: 2 ♂, 29 ♀, Casa Mengo, SW. side Volcán Cacao, 1000 m, vi-x.1987 (*Janzen & Hallwachs*) (BMNH); 1 ♀, Finca Biesnan, 11 km E Quebrada Grande, 500 m, vi.1985 (*Gauld*) (BMNH); 1 ♂, 5 km NE. Quebrada Grande, 600 m, vi.1986 (*Gauld*) (BMNH); 1 ♂, Rincón de la Vieja National Park, 900 m, iii.1984 (*Janzen, Hallwachs & Gauld*) (BMNH); 22 ♂, 29 ♀, Santa Rosa National Park, 300 m, months as above 1984–7 (*Janzen, Hallwachs & Gauld*) (BMNH; MNCR); Puntarenas Prov.: 13 ♂, 11 ♀, Monteverde, 1300 m, i-xii.1985–6 (*Haber*) (BMNH): San José Prov: 1 ♂, Cerro de la Muerte, San Gerardo de Dota, 2430 m, xii.1981 (*Janzen & Hallwachs*) (BMNH); 1 ♂, 1 ♀, San Antonio de Escazú, 1300 m, v-vi.1981 (*Eberhard*) (UM). **Guatemala:** 1 ♂, 10 km W. Amatitlan, 1200 m, vi.1974 (*O'Brien*) (BMNH). **Dominican Republic:** 1 ♂, Santiago Prov., La Cumbre, 1000 m, iv.1978 (*Woodruff*) (BMNH). **Nicaragua:** 2 ♂, Grenada, 3 km W. of Nandaime, vii.1974 (*O'Brien*) (FSCA); 2 ♂, 1 ♀, León, vii.1985 (BMNH, ULN). **Panama:** 3 ♂, 13 ♀, Chiriqui, Guadalupe Arriba, 2200 m, months as above, 1984/5 (*Wolda*) (BMNH). U.S.A.: Florida: 2 ♂, 1 ♀, Alachua Co., Gainesville, x.1971, iii, x.1972 (*Mead*) (FSCA); 1 ♀, same locality, iii.1980 (*Stange*) (FSCA); 2 ♂, 2 ♀, Hillsborough Co., Tampa, iii.1987 (*Eger*) (BMNH); 1 ♀, Marion Co., 14 km SSW. Ocala, x.1975 (*Wiley*) (FSCA).

Ophion clio sp. n.

DESCRIPTION. Mandibles stout, very weakly narrowed apically, with upper tooth slightly broader and slightly longer than the lower tooth, with its blade slightly indented apically; outer mandibular surface punctate, with microreticulation between punctures, and with basal part of mandible broadly concave; distal segment of maxillary palp slender; malar space 0.1 times as long as basal mandibular width. Head in front view with greatest width across eyes 1.4–1.5 times length of head from vertex to clypeal margin; orbits ventrally slightly convergent; clypeus in profile moderately convex, with isolated punctures, apically slightly coriaceous and with margin strongly impressed. Lower face centrally convex, polished and sparsely punctate. Head in dorsal view with genae constricted behind eyes; posterior ocellus contiguous with eye; occipital carina mediodorsally convex at centre, slightly produced upwards, ventrally curved to join hypostomal carina well above base mandible. Antenna quite long and stout, with 60–63 flagellar segments; 20th segment 1.7–1.8 times as long as broad.

Mesoscutum weakly polished and indistinctly punctate, in profile evenly rounded; notauli strongly impressed near anterior end. Mesopleuron polished, centrally finely and quite sparsely punctate; lower corner of epicnemial carina bluntly rounded after concavity, and with upper end inclined towards anterior margin of pleuron, but with upper end evanescent. Scutellum in profile weakly convex, not laterally carinate. Metapleuron moderately convex, punctate. Propodeum in profile abruptly rounded; anterior transverse carina more or less complete, posterior transverse carina more or less complete, laterally strongly raised into crests; lateromedian longitudinal carinae weak but more or less complete; lateral longitudinal carina complete, joined to spiracular margin.

Fore wing length 25–27 mm; CI = 0.63–0.70; ICI = 0.77–0.86; SDI = 1.24–1.26; *cu-a* more or less opposite to the base *Rs&M*; discosubmarginal cell sparsely hirsute, with moderately large glabrous area anteriorly, without a glabrous area along *Rs&M*; *Rs+2r* joining pterostigma slightly proximal to centre; 1st subdiscal cell very sparsely hirsute; 1*m-cu* centrally angled, ramellus much shorter than abscissa of 1*m-cu* between its base and bulla. Hind wing with 9–10 hamuli on *R*1, the distal ones more tightly curved than the proximal ones; 1st abscissa of *Rs* proximally abruptly curved through about 70[; marginal cell proximally short, with junction between *Rs* and *M* far proximal to centre, and with distal abscissa of *Rs* long; proximal 0.3 of marginal cell very sparsely pubescent centrally, becoming glabrous; distal abscissa of *Cu*1 joining *cu-a* slightly closer to 1*A* than to *M*.

Fore leg with tibia slightly flattened, with scattered spines on outer surface. Mid leg with longer tibial spur 1.1–1.2 times length of the shorter. Hind leg with coxa in profile 1.9–2.0 times as long as deep; trochantellus dorsally 0.4–0.6 times as long as broad; hind tarsus slender, the 4th segment 2.6–2.9 times as long as broad; claws of female long and weakly curved, with long close pectinae; claws of male similar but with pectinae shorter and closer together.

Gaster quite slender; tergite 2 in profile about 4 times as long as posteriorly deep; thyridia elliptical and separated from anterior margin of tergite by about 0.5 times its own length. Female with subgenital plate unspecialized; ovipositor moderately long and straight, its sheath slender. Male with subgenital plate transverse, unspecialized; aedeagus apically simple, rounded.

Colour generally yellowish with darker orange on face centrally, mesoscutum and mesosternum; gaster with segments pale yellow centrally, with dorsal, ventral and posterior margins slightly infuscate so gaster appears mottled; interocellar area yellow; flagellum orange; pterostigma orange; wings very slightly yellowish.

VARIATION. The marginal cell of the hind wing of the male is entirely glabrous proximally.

REMARKS. *Ophion clio* is the largest southern Mesoamerican species of the genus. It is most easily recognized by the combination of this large size, its coloration, and the sculpture of the propodeum – the posterior transverse carina is strongly raised laterally, and is close to the anterior carina so the weakly discernible area superomedia is subquadrate. *O. clio* is partially sympatric and synchronous with another large species, *O. uraniae*, but the two differ in colour, shape of the aedeagus, and sculpture of the propodeum.

BIOLOGICAL INFORMATION. *Ophion clio* occupies sites at altitudes ranging from 2200 to above 3100 m on the Cerro de la Muerte, Costa Rica where I have collected it in *Quercus* forests. At Guadalupe Arriba, Panama, it is uncommon and two years light-trapping yielded only a single specimen. Nothing is known of the biology of this insect.

MATERIAL EXAMINED

Holotype ♀, **Costa Rica:** San José Prov.: Cerro de la Muerte, 2 km E. Cerro Asuncion, 3140 m, iv.1984 (*Janzen, Hallwachs & Gauld*) (BMNH)

Paratypes. **Costa Rica:** San José Prov: 1 ♂, Cerro de la Muerte, San Gerardo de Dota, 2430 m, xii.1981 (*Janzen & Hallwachs*) (BMNH); 1 ♀, Cerro de la Muerte, 2 km E. Cerro Asuncion, 3140 m, iv.1984 (*Janzen, Hallwachs & Gauld*) (BMNH). Panama: 1 ♀, Chiriqui, Guadalupe Arriba, v.1984 (*Wolda*) (BMNH).

***Ophion cacaoi* sp. n.**

(Fig. 30)

DESCRIPTION. Mandibles stout, very weakly narrowed apically, with upper tooth slightly longer and stouter than the lower tooth; outer mandibular surface punctate, quite polished, with microreticulation between punctures only discernible basally, and with basal part of mandible broadly concave; distal segment of maxillary palp slender; malar space 0.1 times as long as basal mandibular width. Head in front view with greatest width across eyes 1.4–1.5 times length of head from vertex to clypeal margin; orbits ventrally slightly convergent; clypeus in profile moderately convex, with isolated punctures, polished and with margin strongly impressed. Lower face centrally convex, polished and closely punctate. Head in dorsal view with genae rounded behind eyes; posterior ocellus contiguous with eye; occipital carina mediodorsally convex, at centre slightly produced upwards, ventrally curved to join hypostomal carina well above base mandible. Antenna quite long and fairly stout, with 58–60 flagellar segments; 20th segment 1.5–1.7 times as long as broad.

Mesoscutum weakly polished with fine weak close punctures, and with intervening area slightly coriaceous; mesoscutum in profile evenly rounded; notauli strongly impressed before anterior end, extreme anterior end weak. Mesopleuron polished, centrally finely punctate, with intervening area microreticulate; lower corner of epicnemial carina slightly acutely angled after strong concavity, and with upper end abruptly turned towards anterior margin of pleuron, but usually evanescent, though sometimes reaching pleural margin just above level of lower corner of pronotum. Scutellum in profile weakly convex, not laterally carinate. Metapleuron strongly convex, finely punctate but with fine coriaceous sculpture on areas between punctures. Propodeum in profile rather evenly declivous, weakly polished; anterior transverse carina more or less complete, posterior transverse carina more or less complete, laterally raised into crests; lateromedian longitudinal carinae usually complete to anterior transverse carina, enclosing a subquadrate area superomedia; lateral longitudinal carina complete, joined to spiracular margin by a raised ridge.

Fore wing length 17–18 mm; CI = 0.36–0.50; ICI = 0.84–1.00; SDI = 1.01–1.05; *cu-a* slightly proximal to the base *Rs&M*; discosubmarginal cell sparsely hirsute, with moderately small glabrous area anteriorly, without a glabrous area along *Rs&M*; *Rs+2r* joining pterostigma slightly proximal to its centre; 1st subdiscal cell sparsely but fairly uniformly hirsute; 1*m-cu* centrally rounded, weakly angled, ramellus extremely short, at most about 3 times as long as broad, very much shorter than abscissa of 1*m-cu* between its base and bulla. Hind wing with 6–7 hamuli on *R*1, the distal ones more tightly curved than the proximal ones; 1st abscissa of *Rs* proximally fairly evenly curved through about 70°; marginal cell proximally short, with junction between *Rs* and *M* far proximal to centre, and with distal abscissa of *Rs* long; proximal 0.3 of marginal cell fairly evenly hirsute, not peripherally glabrous; distal abscissa of *Cu*1 joining *cu-a* more of less equidistantly between *M* and 1*A*.

Fore leg with tibia slightly flattened, with isolated spines on outer surface. Mid leg with longer tibial spur 1.4–1.5 times length of the shorter. Hind leg with coxa in profile 1.9–2.2 times as long as deep; trochantellus dorsally 0.1–0.2 times as long as broad; hind tarsus slender, the 4th segment 2.7–2.8 times as long as broad; claws of female long and weakly curved, with long close pectinae; claws of male similar but with pectinae shorter and closer together.

Gaster moderately slender; tergite 2 in profile about 3 times as long as posteriorly deep; thyridia elliptical and separated from anterior margin of tergite by about 0.5 times its own length. Female with subgenital plate unspecialized; ovipositor moderately long and straight, its sheath slender. Male with subgenital plate transverse, unspecialized; aedeagus apically curved, culminating in a short acute process.

Colour generally reddish brown, with orbits, vertex and interocellar area yellowish, mesoscutal margin, scutellum and two marks on upper part of mesopleuron yellowish; flagellum orange-brown; pterostigma orange; wings quite strongly yellowish.

REMARKS. *Ophion cacaoi* is structurally rather similar to *O. uraniae*. Both species have similarly modified epicnemial carinae and apically acute aedeagi, suggesting they are a sister-species pair. However, they differ consistently in a number of features. *O. cacaoi* has a very short ramellus, a more or less evenly hirsute marginal cell in the hind wing and the area superomedia is distinct and subquadrate to transverse; *O. uraniae* has a longer ramellus, a proximally narrowly glabrous marginal cell in the hind wing and, if its area superomedia is discernible, then it is elongate. *O. cacaoi* also has a larger ICI than *uraniae*, a shorter and stouter hind trochantellus, stouter antennae, and has two rather than three pale marks on the upper part of the mesopleuron.

BIOLOGICAL INFORMATION. *Ophion cacaoi* is only known to occur in forests on the upper slopes of Volcán Cacao in north-western Guanacaste, Costa Rica. This mountain, together with Volcán Orosi, provides a rather isolated island of moderate altitude forest at the northern end of the Cordillera Guanacaste. Possibly this species arose from a geographically isolated population of *O. uraniae*, or the ancestral population of both was split by a vicariance event. Nothing is known of the biology of *O. cacaoi*.

MATERIAL EXAMINED

Holotype ♂, **Costa Rica:** Guanacaste Prov., Casa Mengo on SW. side of Volcán Cacao, 1000 m, vi.1987 (*Janzen*) (BMNH).

Paratypes. 3 ♂, 2 ♀, same locality as holotype, vi-vii.1987 (*Janzen*) (BMNH).

Ophion uraniae sp. n.

(Figs 47, 49)

DESCRIPTION. Mandibles stout, very weakly narrowed apically, with upper tooth slightly longer than the lower tooth; outer mandibular surface punctate, quite polished, with microreticulation between punctures only discernible basally, and with basal part of mandible broadly concave; distal segment of maxillary palp slender; malar space 0.1 times as long as basal mandibular width. Head in front view with greatest width across eyes 1.3–1.5 times length of head from vertex to clypeal margin; orbits ventrally slightly convergent; clypeus in profile moderately convex, with isolated punctures, polished and with margin strongly impressed. Lower face centrally convex, polished and quite closely punctate. Head in dorsal view with genae constricted behind eyes; posterior ocellus contiguous with eye; occipital carina mediodorsally convex, at centre slightly produced upwards, ventrally curved to join hypostomal carina well above base mandible. Antenna quite long and fairly slender, with 54–57 flagellar segments; 20th segment 1.8–2.5 times as long as broad.

Mesoscutum weakly polished with fine weak close punctures, and with intervening area slightly coriaceous; mesoscutum in profile evenly rounded; notauli moderately impressed near anterior end. Mesopleuron polished, centrally finely punctate, with intervening area microreticulate; lower corner of epicnemial carina acutely angled after concavity, and with upper end abruptly turned towards anterior margin of pleuron, but usually evanescent, though sometimes reaching pleural margin just above level of lower corner of pronotum. Scutellum in profile weakly convex, not laterally carinate. Metapleuron strongly convex, finely punctate. Propodeum in profile rather evenly declivous, strongly polished; anterior transverse carina more or less complete, posterior transverse carina more or less complete, laterally raised into crests; lateromedian longitudinal carinae usually complete to posterior transverse carina, less frequently present to anterior transverse carina in which case it encloses an elongate area superomedia; lateral longitudinal carina complete, joined to a rather remote spiracular margin by a raised ridge.

Fore wing length 16–21 mm; CI = 0.44–0.59; ICI = 0.44–0.63; SDI = 1.19–1.27; *cu-a* slightly proximal to the base *Rs&M*; discosubmarginal cell sparsely hirsute, with moderately small glabrous area anteriorly, without a glabrous area along *Rs&M*; *Rs+2r* joining pterostigma slightly proximal to its centre; 1st subdiscal cell sparsely hirsute; 1*m-cu* centrally angled, ramellus much shorter than abscissa of 1*m-cu* between its base and bulla. Hind wing with 6–8 hamuli on *R*1, the distal ones more tightly curved than the proximal ones; 1st abscissa of *Rs* proximally abruptly curved through about 80°; marginal cell proximally short, with junction between *Rs* and *M* far proximal to centre, and with distal abscissa of *Rs* long; proximal 0.3 of marginal cell centrally hirsute, peripherally glabrous; distal abscissa of *Cu*1 joining *cu-a* more or less equidistantly between *M* and 1*A*.

Fore leg with tibia subcylindrical, with isolated spines on outer surface. Mid leg with longer tibial spur 1.3–1.4 times length of the shorter. Hind leg with coxa in profile 1.9–2.2 times as long as deep; trochantellus dorsally 0.4–0.5 times as long as broad; hind tarsus slender, the 4th segment 2.7–2.9 times as long as broad; claws of female long and weakly curved, with long close pectinae; claws of male similar but with pectinae shorter and closer together.

Gaster quite slender; tergite 2 in profile about 4 times as long as posteriorly deep; thyridia elliptical and separated from anterior margin of tergite by about 0.5 times its own length. Female with subgenital plate unspecialized; ovipositor moderately long and straight, its sheath slender. Male with subgenital plate transverse, unspecialized; aedeagus apically culminating in a short acute process.

Colour generally reddish brown, with orbits, vertex and interocellar area yellowish, mesoscutal margin, scutellum and three marks on upper part of mesopleuron yellow; flagellum orange; pterostigma orange; wings quite strongly yellowish.

VARIATION. One specimen from Volcán Poás lacks the paler markings on the alitrunk. There is a tendency for many individuals to have the lateromedian longitudinal carinae of the propodeum fused to form a single median longitudinal carina

REMARKS. *Ophion uraniae* is most easily recognized by the angulate lower corner of the epicnemial carina. Males are particularly distinctive on account of the apically acute aedeagus, and the colour pattern is generally quite distinctive. It resembles *O. cacaoi* in these features but the two species may be separated by the characters given in the key (and see also remarks under *O. cacaoi*). *O. uraniae* occurs at higher altitude than *cacaoi*, and the two species are geographically separated, the former occurs in Central Costa Rica and south into northern Panama, whilst the latter is only known from the extreme northern end of the Cordillera Guanacaste. *O. uraniae* has been collected in large numbers with *O. thaliae*, but the latter is smaller, has the epicnemial carina rounded ventrally and lacks any trace of a lateral longitudinal carina.

BIOLOGICAL INFORMATION. *Ophion uraniae* occurs in central Costa Rica, and thence southwards at moderately high elevations (2200–2500 m) into northern Panama. It can occur in large numbers; 34 individuals were taken in Costa Rica during a single night at one site. It also seems to be active throughout the year as two years collecting at Guadalupe Arriba, Panama yielded the following seasonal distribution:

J	F	M	A	M	J	J	A	S	O	N	D
4	6	6	4	7	4	3	7	7	4	6	2

Nothing is known of the hosts of this insect.

MATERIAL EXAMINED

Holotype ♀, **Costa Rica:** San José Prov: Cerro de la Muerte, San Gerardo de Dota, 2430 m, xii.1981 (*Janzen & Hallwachs*) (BMNH)

Paratypes. **Costa Rica:** Alajuela Prov.: 1 ♂, 1 ♀, Volcán Poás National Park, 2350 m, vii.1982 (*Janzen & Hallwachs*) (BMNH); 2 ♂, 1 ♀, same locality, xii.1982 (*Janzen & Hallwachs*) (BMNH): San José Prov: 17 ♂, 17 ♀, Cerro de la Muerte, San Gerardo de Dota, 2430 m, xii.1981 (*Janzen & Hallwachs*) (BMNH, CNC, MNCR, TC, USNM). **Panama:** 34 ♂, 26 ♀, Chiriqui, Guadalupe Arriba, 2200 m, months as above, 1984–5 (*Wolda*) (BMNH)

Ophion erato sp. n.

(Figs 29, 52)

DESCRIPTION. Mandibles stout, very weakly narrowed apically, with upper tooth of similar shape to but slightly longer than the lower tooth; outer mandibular surface polished, sparsely punctate, and with basal part of mandible slightly concave; distal segment of maxillary palp slender; malar space 0.1 times as long as basal mandibular width. Head in front view with greatest width across eyes 1.3 times length of head from vertex to clypeal margin; orbits ventrally subparallel; clypeus in profile moderately convex, with isolated punctures and with margin strongly impressed. Lower face centrally almost flat, polished and sparsely punctate. Head in dorsal view with genae rounded behind eyes; posterior ocellus separated from eye by about 0.1 times its own maximum diameter; occipital carina mediodorsally convex at centre, ventrally curved to join hypostomal carina well above base mandible. Antenna quite long and slender, with 48–55 flagellar segments; 20th segment 2.1–2.3 times as long as broad.

Mesoscutum quite strongly polished and indistinctly microreticulate, in profile evenly rounded; notauli very weakly impressed near anterior end. Mesopleuron weakly polished, centrally finely microreticulate with minute sparse punctures; lower corner of epicnemial carina bluntly rounded after concavity, and with upper end abruptly curved towards anterior margin of pleuron which it reaches just above level of lower corner of pronotum. Scutellum in profile weakly convex, not laterally carinate. Metapleuron moderately convex, microreticulate with very fine punctures. Propodeum in profile abruptly declivous; anterior transverse carina more or less complete, posterior transverse carina present laterally; lateromedian longitudinal carinae weak, discernible posteriorly; lateral longitudinal carina from complete to present only in anterior half, joined to spiracular margin.

Fore wing length 13–15 mm; CI = 0.40; ICI = 0.52–0.60; SDI = 1.29–1.31; *cu-a* proximal to the base *Rs&M* by about 0.3 times its own length; discosubmarginal cell sparsely hirsute, with a large glabrous area anteriorly, without a glabrous area along *Rs&M*; *Rs+2r* joining pterostigma close to base; 1st subdiscal cell anteriorly glabrous, posteriorly hirsute; *1m-cu* centrally angled, ramellus unusually long, but shorter than abscissa of *1m-cu* between its base and bulla. Hind wing with 5–6 hamuli on *R*1, the distal ones more tightly curved than the proximal ones; 1st abscissa of *Rs* proximally abruptly curved through about 60°; marginal cell proximally short, with junction between *Rs* and *M* far proximal to centre, and with distal abscissa of *Rs* long; proximal 0.3 of marginal cell very closely hirsute centrally, anteriorly narrowly glabrous, but otherwise without a distinct glabrous periphery; distal abscissa of *Cu*1 joining *cu-a* slightly closer to *1A* than to *M*.

Fore leg with tibia subcylindrical, without obvious spines on outer surface. Mid leg with longer tibial spur 1.4–1.6 times length of the shorter. Hind leg with coxa in profile 1.7–2.0 times as long as deep; trochantellus dorsally 0.5–0.7 times as long as broad; hind tarsus slender, the 4th segment 2.8–3.0 times as long as broad; claws of female very long and weakly curved, with long close pectinae, those of male similar but with pectinae much closer together and with apical tooth unusually short.

Gaster quite slender; tergite 2 in profile about 4 times as long as posteriorly deep; thyridia elliptical and separated from anterior margin of tergite by about 0.5 times its own length. Female with subgenital plate long but unspecialized; ovipositor quite short and fairly stout; ovipositor sheath slender. Male with subgenital plate transverse, unspecialized; aedeagus apically simple, rounded.

Colour generally bright yellowish with mesoscutal vittae, mesosternum and tergites 5♀ infuscate; legs and antennae golden;pterostigma centrally brown, peripherally pallid; wings almost hyaline.

VARIATION. The 2nd discal cell of the male is unusually short and the bulla in *1m-cu* is closer to *2m-cu* than it is to the ramellus. These very unusual features are not shared by the female.

REMARKS. *Ophion erato* is most distinctive because of the slender flagellum, the very long ramellus and the posteriorly infuscate gaster. The marginal cell of the hind wing is more uniformly hirsute proximo-posteriorly than are other species. The claws of the male are longer than those of many other species and have unusually short apical teeth that are no longer than the pectinae.

BIOLOGICAL INFORMATION. Only two specimens of *Ophion erato* are known. One, a male, was collected at a moderately high altitude site on the Cerro de la Muerte, Costa Rica, and the female was taken at a similar altitude in northern Panama. This female was the only specimen of *O. erato* collected in two years' continuous sampling. Its host is not known.

MATERIAL EXAMINED

Holotype ♂, **Costa Rica:** San José Prov: Cerro de la Muerte, San Gerardo de Dota, 2430 m, xii.1981 (*Janzen & Hallwachs*) (BMNH).

Paratype. **Panama:** 1 ♀, Chiriqui, Guadalupe Arriba, 2200 m, x.1985 (*Wolda*) (BMNH).

Ophion terpsichore sp. n.

(Fig. 53)

Description. Mandibles stout, very weakly narrowed apically, with upper tooth slightly broader and slightly longer than the lower tooth; outer mandibular surface punctate, coriaceous between punctures, and with basal part of mandible slightly concave; distal segment of maxillary palp slender; malar space 0.1 times as long as basal mandibular width. Head in front view with greatest width across eyes 1.35 times length of head from vertex to clypeal margin; orbits ventrally slightly convergent; clypeus in profile moderately convex, coriaceous, with isolated punctures and with margin strongly impressed. Lower face centrally convex, polished and sparsely punctate. Head in dorsal view with genae rounded behind eyes; posterior ocellus contiguous with eye; occipital carina mediodorsally convex, ventrally curved to join hypostomal carina well above base mandible. Antenna quite long and stout, with 52 flagellar segments; 20th segment 1.5 times as long as broad.

Mesoscutum weakly polished, granulate and indistinctly punctate, in profile abruptly rounded; notauli weakly impressed near anterior end. Mesopleuron weakly polished, granulate, with very obscure minute punctures that are separated by about twice their own diameters; lower corner of epicnemial carina bluntly rounded after concavity, and with upper end abruptly curved to join anterior margin of pleuron above level of lower corner of pronotum. Scutellum in profile quite strongly convex, not laterally carinate. Metapleuron weakly convex, granulo-punctate. Propodeum in profile abruptly rounded; anterior transverse carina more or less complete, posterior transverse carina only present laterally as crests; lateromedian longitudinal carinae weak, more or less absent; lateral longitudinal carina weak but complete, joined to spiracular margin.

Fore wing length 14 mm; CI = 0.61; ICI = 0.50; SDI = 1.15; *cu-a* slightly proximal to the base *Rs&M*; discosubmarginal cell evenly hirsute, with a large glabrous area anteriorly, without a glabrous area along *Rs&M*; *Rs+2r* joining pterostigma near centre; 1st subdiscal cell very sparsely hirsute; 1*m-cu* centrally angled, ramellus very long. Hind wing with 8 hamuli on *R*1, the distal ones more tightly curved than the proximal ones; 1st abscissa of *Rs* proximally evenly curved through about 80°; marginal cell proximally short, with junction between *Rs* and *M* far proximal to centre, and with distal abscissa of *Rs* long; proximal 0.3 of marginal cell fairly evenly hirsute centrally, peripherally glabrous; distal abscissa of *Cu*1 joining *cu-a* almost equidistant between *M* and 1*A*.

Fore leg with tibia quite strongly flattened, with isolated spines on outer surface. Mid leg with longer tibial spur 1.3 times length of the shorter. Hind leg with coxa in profile 1.7 times as long as deep; trochantellus dorsally 0.4 times as long as broad; hind tarsus slender, the 4th segment 2.6 times as long as broad; claws of male long and weakly curved, with long close pectinae.

Gaster quite slender; tergite 2 in profile about 4 times as long as posteriorly deep; thyridia elliptical and separated from anterior margin of tergite by about 0.5 times its own length. Female unknown. Male with subgenital plate transverse, unspecialized; aedeagus apically simple, rounded.

Head, lateral part of alitrunk and scutellum bright yellowish; mesoscutum, except for lateral mark, mesopleuron in a narrow band below subalar prominence, mesosternum and propodeum dark brown; gaster with segments 1–3 dark brown, remainder more orange-brown; interocellar area yellow; flagellum orange, distally slightly darker; pterostigma orange, distally very pale yellowish; wings more or less hyaline.

Remarks. *Ophion terpsichore* is most easily recognized by the combination of its coloration, venation and the sculpture of the mesoscutum. No other Mesoamerican species of *Ophion* exhibits this colour pattern. The very long ramellus and ventrally dark mesosternum are derived features which this species shares with *O. erato* and the two may be related.

Biological Information. *Ophion terpsichore* is only known to occur at one moderately high altitude site in Costa Rica. Nothing is known of its biology.

Material Examined

Holotype ♂, **Costa Rica:** San José Prov: Cerro de la Muerte, San Gerardo de Dota, 2430 m, xii.1981 (*Janzen & Hallwachs*) (BMNH).

Ophion melpomene sp. n.

(Figs 28, 31)

Description. Mandibles stout, very weakly narrowed apically, teeth of equal length but with upper tooth very distinctly broader and less acute than the lower tooth, with its blade slightly indented apically; outer mandibular surface punctate, with granulation between punctures, and with basal part of mandible broadly concave; distal segment of maxillary palp slender; malar space 0.1 times as long as basal mandibular width. Head in front view with greatest width across eyes 1.35–1.45 times length of head from vertex to clypeal margin; orbits ventrally slightly convergent; clypeus in profile moderately convex, weakly granulate with isolated punctures, apically slightly coriaceous and with margin strongly impressed. Lower face centrally convex, weakly granulate and sparsely punctate. Head in dorsal view with genae constricted behind eyes; posterior ocellus almost contiguous with eye; occipital carina mediodorsally convex, at centre slightly produced upwards, ventrally curved to join hypostomal carina well above base mandible. Antenna quite long and slender, with 51 flagellar segments; 20th segment 2.0–2.1 times as long as broad.

Mesoscutum weakly polished microreticulate, in profile evenly rounded; notauli strongly impressed on anterior 0.3. Mesopleuron weakly polished, centrally finely and quite sparsely punctate, the intervening area microreticulate; lower corner of epicnemial carina bluntly rounded after concavity, and with upper end abruptly curved towards anterior margin of pleuron which it joins just above level of lower corner of pronotum. Scutellum in profile weakly convex, not laterally carinate. Metapleuron moderately convex, microreticulate, very finely punctate. Propodeum in profile evenly declivous; anterior transverse carina more or less complete, posterior transverse carina discernible only laterally as crests; lateromedian longitudinal carinae represented by a single median weak carina; lateral longitudinal carina strong anteriorly, joined to spiracular margin, posteriorly becoming a groove.

Fore wing length 17–18 mm; CI = 0.76–0.82; ICI = 0.40–0.44; SDI = 1.23–1.26; *cu-a* more or less opposite to the base *Rs&M*; discosubmarginal cell sparsely hirsute, with moderately large glabrous area anteriorly, without a glabrous area along *Rs&M*; *Rs+2r* joining pterostigma near centre; 1st subdiscal cell evenly hirsute; 1*m-cu* centrally angled, ramellus shorter than abscissa of 1*m-cu* between its base and bulla. Hind wing with 8 hamuli on *R*1, the distal ones more tightly curved than the proximal ones; 1st abscissa of *Rs* proximally abruptly curved through about 70°; marginal cell proximally short, with junction between *Rs* and *M* far proximal to centre, and with distal abscissa of *Rs* long; proximal 0.3 of marginal cell densely hirsute centrally, peripherally glabrous; distal abscissa of *Cu*1 joining *cu-a* equidistant between 1*A* and *M*.

Fore leg with tibia slightly flattened, with isolated spines on outer surface. Mid leg with longer tibial spur 1.3–1.4 times length of the shorter. Hind leg with coxa in profile 1.9–2.0 times as long as deep; trochantellus dorsally 0.4–0.6 times as long as broad; hind tarsus slender, the 4th segment 2.8–3.0 times as long as broad; claws of male long and weakly curved, with pectinae moderately short and close together.

Gaster quite slender; tergite 2 in profile about 4 times as long as posteriorly deep; thyridia elliptical and separated from anterior margin of tergite by about its own length. Female unknown. Male with subgenital plate transverse, unspecialized; aedeagus apically simple, rounded.

Colour generally uniformly reddish brown with only head predominantly yellowish; interocellar area yellow; flagellum orange, distally infuscate; pterostigma orange; wings more or less hyaline.

REMARKS. This rather unremarkable species is most easily recognized by the finely microreticulate mesothorax and the venational features mentioned in the key. The strongly impressed notauli and the propodeal sculpture are features in which *O. melpomene* resembles *O. polyhymniae* and the two species may be related.

BIOLOGICAL INFORMATION. In Costa Rica *Ophion melpomene* has only been collected in forest on the summit of Volcán Poás at an altitude of 2350 m. Nothing is known of the biology of this insect.

MATERIAL EXAMINED

Holotype ♂, **Costa Rica:** Alajuela Prov: Volcán Poás National Park, 2350 m, xii.1981 (*Janzen & Hallwachs*) (BMNH)

Paratype. 1 ♂, same data as holotype (BMNH).

Ophion arribai sp. n.

(Figs 27, 32)

DESCRIPTION. Mandibles stout, very weakly narrowed apically, with upper tooth slightly longer and broader than the lower tooth; outer mandibular surface punctate, weakly polished, with microreticulation between punctures only discernible basally, and with basal part of mandible broadly concave; distal segment of maxillary palp slender; malar space 0.1 times as long as basal mandibular width. Head in front view with greatest width across eyes 1.3–1.5 times length of head from vertex to clypeal margin; orbits ventrally slightly convergent; clypeus in profile moderately convex, with isolated punctures, microreticulate and with margin strongly impressed. Lower face centrally convex, weakly polished, granulate with very obscure punctures. Head in dorsal view with genae constricted behind eyes; posterior ocellus contiguous with eye; occipital carina mediodorsally convex, ventrally curved to join hypostomal carina well above base mandible. Antenna quite long and fairly slender, with 53–57 flagellar segments; 20th segment 1.8–1.9 times as long as broad.

Mesoscutum weakly polished, granulate, with fine weak close punctures; mesoscutum in profile evenly rounded; notauli strongly impressed near anterior end. Mesopleuron polished, centrally finely punctate, with intervening area microreticulate; lower corner of epicnemial carina bluntly rounded after concavity, and with upper end inclined towards and joining anterior margin of pleuron well above level of lower corner of pronotum. Scutellum in profile quite strongly convex, not laterally carinate. Metapleuron moderately convex, finely punctate and with intervening areas microreticulate. Propodeum in profile rather abruptly declivous, weakly polished; anterior transverse carina strong, more or less complete, posterior transverse carina only represented by lateral vestiges; lateromedian longitudinal carinae vestigial, at most discernible as a weak median wrinkle; lateral longitudinal carina weak, usually more or less complete, joined to a rather remote spiracular margin by a raised ridge.

Fore wing length 21–23 mm; CI = 0.50–0.55; ICI = 0.73–0.84; SDI = 1.14–1.17; *cu-a* slightly proximal to the base *Rs&M*; discosubmarginal cell closely hirsute, with a small glabrous area anteriorly, though the proximal part of the anterior corner is densely hirsute and without a glabrous area along *Rs&M*; *Rs+2r* basally incrassate, joining pterostigma close to its base; 1st subdiscal cell quite densely hirsute; 1*m-cu* centrally angled, ramellus very short, shorter than abscissa of 1*m-cu* between its base and bulla. Hind wing with 8–10 hamuli on *R*1, the distal ones moderately curved and unexceptional, the proximal ones almost straight and virtually parallel to *R*1, 1st abscissa of *Rs* proximally abruptly curved through about 80°; marginal cell proximally short, with junction between *Rs* and *M* far proximal to centre, and with distal abscissa of *Rs* long; proximal 0.3 of marginal cell centrally hirsute, peripherally glabrous; distal abscissa of *Cu*1 joining *cu-a* slightly closer to *M* than to 1*A*.

Fore leg with tibia slightly flattened, with isolated spines on outer surface. Mid leg with longer tibial spur 1.3–1.4 times length of the shorter. Hind leg with coxa in profile 1.9–2.1 times as long as deep; trochantellus dorsally 0.4–0.5 times as long as broad; hind tarsus slender, the 4th segment 2.6–2.8 times as long as broad; claws of female exceptionally long and evenly curved, with long close pectinae; claws of male similar but slightly shorter with pectinae shorter and closer together.

Gaster quite slender; tergite 2 in profile about 4 times as long as posteriorly deep; thyridia elliptical and separated from anterior margin of tergite by about 0.5 times its own length. Female with subgenital plate unspecialized; ovipositor moderately long and straight, its sheath slender. Male with subgenital plate transverse, unspecialized; aedeagus apically rounded.

Colour generally orange-brown, with orbits, vertex, interocellar area and scutellum whitish; flagellum orange; pterostigma orange, posteriorly black margined; wings quite weakly infumate.

REMARKS. *Ophion arribai* may easily be recognized by the shape of the glabrous area in the fore wing, the basally slightly thickened *Rs+2r*, the characteristic form of the distal hamuli and by the unusually long claws. Superficially it resembles *O. uraniae* (with which it is sympatric) but *O. arribai* has the lower corner of the epicnemial carina rounded and lacks the extensive propodeal carination exhibited by *O. uraniae*. *O. arribai* resembles *O. flavoorbitalis* in the position and form of *Rs+2r* in the fore wing and the two species may be related.

BIOLOGICAL INFORMATION. *Ophion arribai* is only known to occur at Guadalupe Arriba at an altitude of 2000 m in northern Panama. In two years' sampling only four individual were taken, in April, June, July and September. Nothing is known of the biology of this species.

MATERIAL EXAMINED

Holotype ♀, **Panama:** Chiriqui, Guadalupe Arriba, 2200 m, iv.1985 (*Wolda*) (BMNH)
Paratypes. 1 ♂, 2 ♀, same locality, vii.1984, ix.1984 & vi.1985 (*Wolda*) (BMNH, USNM).

***Ophion thaliae* sp. n.**

(Figs 34, 46, 50)

DESCRIPTION. Mandibles stout, very weakly narrowed apically, with upper tooth very slightly broader and longer than the lower tooth; outer mandibular surface punctate, coriaceous between punctures, and with basal part of mandible quite strongly concave; distal segment of maxillary palp slender; malar space 0.1 times as long as basal mandibular width. Head in front view with greatest width across eyes 1.3–1.4 times length of head from vertex to clypeal margin; orbits ventrally distinctly convergent; clypeus in profile moderately convex, polished, with isolated punctures and with margin strongly impressed. Lower face centrally convex, polished and sparsely punctate. Head in dorsal view with genae rounded behind eyes;

posterior ocellus almost contiguous with eye; occipital carina mediodorsally convex, ventrally curved to join hypostomal carina well above base mandible, though its lower end can be weak. Antenna quite long and stout, with 50–53 flagellar segments; 20th segment 2.0–2.1 times as long as broad.

Mesoscutum polished, slightly granulate and indistinctly punctate, in profile abruptly rounded; notauli distinctly impressed near anterior end. Mesopleuron polished, with very obscure minute punctures that are separated by about twice their own diameters; lower corner of epicnemial carina bluntly rounded after concavity, and with upper end abruptly curved to join anterior margin of pleuron above level of lower corner of pronotum. Scutellum in profile evenly convex, not laterally carinate. Metapleuron moderately convex, punctate. Propodeum in profile abruptly rounded; anterior transverse carina more or less complete, posterior transverse carina usually only present laterally as crests; lateromedian longitudinal carinae weak but more or less complete; lateral longitudinal carina only present anteriorly, strong and curving back to join spiracular margin.

Fore wing length 15–16 mm; CI = 0.51–70; ICI = 0.47–74; SDI = 1.27–1.32; *cu-a* slightly proximal to the base *Rs&M*; discosubmarginal cell evenly hirsute, with a large glabrous area anteriorly, without a glabrous area along *Rs&M*; *Rs+2r* joining pterostigma slightly proximal to centre; 1st subdiscal cell sparsely hirsute; 1*m-cu* centrally angled, ramellus from slightly to distinctly shorter than abscissa of 1*m-cu* between its base and bulla. Hind wing with 5–6 hamuli on *R*1, the distal ones more tightly curved than the proximal ones; 1st abscissa of *Rs* proximally evenly curved through about 70°; marginal cell proximally short, with junction between *Rs* and *M* far proximal to centre, and with distal abscissa of *Rs* long; proximal 0.3 of marginal cell broadly glabrous; distal abscissa of *Cu*1 joining *cu-a* slightly closer to 1*A* than to *M*.

Fore leg with tibia weakly flattened, with isolated spines on outer surface. Mid leg with longer tibial spur 1.4–1.6 times length of the shorter. Hind leg with coxa in profile 1.7–1.8 times as long as deep; trochantellus dorsally 0.4–0.5 times as long as broad; hind tarsus slender, the 4th segment 2.6–2.8 times as long as broad; claws of female long and weakly curved, with long moderately close pectinae, claws of male similar but with pectinae shorter and closer.

Gaster quite slender; tergite 2 in profile about 4 times as long as posteriorly deep; thyridia oval, separated from anterior margin of tergite by 0.5–1.0 times its own length. Female with subgenital plate long, unspecialized; ovipositor straight, its sheath narrow. Male with subgenital plate transverse, unspecialized; aedeagus apically simple, rounded.

Colour generally orange-yellow, with mesoscutal vittae more orange; interocellar area yellow; flagellum orange, distally slightly darker; pterostigma orange; wings more or less hyaline.

VARIATION. The posterior transverse carina of the propodeum is usually only discernible laterally, but some individuals have it complete except centrally between the lateromedian longitudinal carinae.

REMARKS. *Ophion thaliae* is most easily recognized by the combination of the glabrous distal part of the marginal cell of the hind wing, the form of the lateral propodeal carina, its size and coloration, and by the venation of the fore wing. Structurally it is rather unexceptional, and perhaps it most closely resembles *O. flavoorbitalis* from which it can be distinguished by the characters given in the key.

BIOLOGICAL INFORMATION. *Ophion thaliae* is only known to occur at one moderately high altitude site in Costa Rica where it has been taken in moderately large numbers with *O. uraniae*. Nothing is known of the biology of this insect.

MATERIAL EXAMINED

Holotype ♀, **Costa Rica:** San José Prov: Cerro de la Muerte, San Gerardo de Dota, 2430 m, xii.1981 (*Janzen & Hallwachs*) (BMNH)

Paratypes. **Costa Rica:** San José Prov: 5 ♂, 7 ♀, Cerro de la Muerte, San Gerardo de Dota, 2430 m, xii.1981 (*Janzen & Hallwachs*) (BMNH, CNC, MNCR, TC).

Ophion flavoorbitalis Cameron

(Figs 33, 48, 51)

Ophion flavo-orbitalis Cameron, 1886: 294. Lectotype ♀, PANAMA (BMNH) designated by Morley (1912: 55) [examined].

Ophion flavoorbitalis Cameron; Hooker, 1912: 49.

[*Ophion intricatus* Brullé; Morley, 1912: 55. Misidentification.]

DESCRIPTION. Mandibles stout, very weakly narrowed apically, with upper tooth of similar length to, but distinctly broader and blunter than the lower tooth; outer mandibular surface punctate, with microreticulation between punctures, and with basal part of mandible broadly concave; distal segment of maxillary palp slender; malar space 0.1 times as long as basal mandibular width. Head in front view with greatest width across eyes 1.4 times length of head from vertex to clypeal margin; orbits ventrally slightly convergent; clypeus in profile moderately convex, with isolated punctures, apically slightly coriaceous and with margin strongly impressed. Lower face centrally convex, polished and punctate. Head in dorsal view with genae constricted behind eyes; posterior ocellus contiguous with eye; occipital carina mediodorsally convex, at centre slightly produced upwards, ventrally curved to join hypostomal carina well above base mandible. Antenna quite long and stout, with 52–53 flagellar segments; 20th segment 1.4–1.5 times as long as broad.

Mesoscutum polished and distinctly punctate with traces of microreticulation between punctures, in profile weakly and evenly rounded, with notauli moderately weakly impressed near anterior end. Mesopleuron polished, centrally finely and quite sparsely punctate; lower corner of epicnemial carina bluntly rounded after concavity, and with upper end inclined towards anterior margin of pleuron, which it reaches above level of lower corner of pronotum. Scutellum in profile weakly convex, not laterally carinate. Metapleuron moderately convex, obsoletely punctate with distinct microreticulation. Propodeum in profile abruptly rounded; anterior transverse carina strong, more or less complete, posterior transverse carina strong, complete, laterally strongly raised into crests; lateromedian longitudinal carinae strong and more or less complete to the anterior transverse carina, enclosing an elongate area superomedia; lateral longitudinal carina complete, joined to spiracular margin.

Fore wing length 18–19 mm; CI = 0.43–0.61; ICI = 0.71–0.73; SDI = 1.16–1.23; *cu-a* proximal to the base *Rs&M* by about 0.2 times its own length; discosubmarginal cell evenly hirsute, with a rather small glabrous area anteriorly, and without a glabrous area along *Rs&M*; *Rs+2r* strongly thickened basally, joining pterostigma close to base; 1st subdiscal cell unusual in being broad proximally and strongly tapered distally, sparsely hirsute; 1*m-cu* centrally angled, the ramellus about as long as abscissa of 1*m-cu* between its base and bulla. Hind wing with 6 hamuli on *R*1, the distal ones more tightly curved than the proximal ones; 1st abscissa of *Rs* slightly incrassate, rather irregularly curved so it is slightly wavy, in total turned through about 60°; marginal cell proximally short, with junction between *Rs* and *M* far proximal to centre, and with distal abscissa of *Rs* long; proximal 0.3 of marginal cell glabrous; distal abscissa of *Cu*1 joining *cu-a* distinctly closer to *M* than to 1*A*.

Fore leg with tibia slightly flattened, without obvious spines on outer surface. Mid leg with longer tibial spur 1.4 times length of the shorter. Hind leg with coxa in profile 1.7 times as long as deep; trochantellus dorsally 0.2–0.3 times as long as broad; hind tarsus slender, the 4th segment 2.6–2.7 times as long as broad; claws of female long and weakly curved, with long close pectinae; claws of male similar but with pectinae shorter and closer together.

Gaster quite slender; tergite 2 in profile about 4 times as long as posteriorly deep; thyridia large, obovate and separated from anterior margin of tergite by about its own length. Female with subgenital plate unspecialized; ovipositor moderately long and straight, its sheath slender. Male with subgenital plate transverse, unspecialized; aedeagus apically simple, rounded.

Colour generally orange-brown with head more yellowish; interocellar area yellow; flagellum brownish orange; pterostigma orange; wings very slightly yellowish.

REMARKS. *Ophion flavoorbitalis* is most easily recognized by the combination of distally strongly tapered 1st subdiscal cell in the fore wing, and the slightly wavy *Rs* and proximally glabrous marginal cell in the hind wing. The base of *Rs+2r* in the fore wing is slightly stouter than that of most other species though it is similar to that found in *O. arribai* (see that species).

BIOLOGICAL INFORMATION. *Ophion flavoorbitalis* is only known to occur in Costa Rica and Panama. The paralectotype from Cordoba, Mexico is a different species, as are Morley's specimens from Brazil (Morley, 1912). *O. flavoorbitalis* seems to occur at a rather lower altitude than many other species of *Ophion* as it has only been collected below 1400 m. It is a very uncommon species in collections and nothing is known of its biology.

MATERIAL EXAMINED

Lectotype ♀, **Panama:** Volcán de Chiriqui, 850–1300 m (BMNH).

Costa Rica: Cartago Prov: 1 ♂, Tapanti, Río Grande de Orosi, 1300–1400 m, i.1985 (*Janzen & Hallwachs*) (BMNH).

AGATHOPHIONA Westwood

Agathophiona Westwood, 1882: 19. Type-species: *Agathophiona fulvicornis* Westwood, by monotypy.

DIAGNOSIS. Shining black to blue-black species with infumate wings; fore wing length 10–14 mm. Very similar to *Ophion* except that it has the glossae greatly elongated (Fig. 18), the ocelli are small and far removed from the eyes, tergite 3 of the gaster is longer than tergite 2 and the female has a very large subgenital plate

Remarks. This genus contains a single species, *Agathophiona fulvicornis*, which is endemic to Mexico. It flies in bright sunlight and can often be seen feeding from the flowers of Compositae. No host records are known.

The *SICOPHION* genus-group

JANZOPHION Gauld

Janzophion Gauld, 1985: 128. Type-species: *Janzophion nebosus* Gauld, by original designation.

Diagnosis. Predominantly yellowish brown insects with some black mottling; wings hyaline with infumate patch near pterostigma; fore wing length 14–16 mm. Mandibles not or barely twisted; maxillae and labium unspecialized; clypeus apically truncate or slightly convex; occipital carina absent. Notauli absent; mesopleural furrow vestigial; posterior transverse carina of mesosternum complete. Fore wing (Fig. 7) with *Rs+2r* centrally angled, basally broadened; discosubmarginal cell with a glabrous area anteriorly; pterostigma quite stout; *1m-cu* sinuous or bowed; hind wing with *Rs* bowed; *R*1 unusual in having penultimate hamulus greatly lengthened; distal abscissa of *Cu*1 basally much closer to 1*A* than it is to *M*. Fore tibial spur with membrane behind comb. Gaster slender; second segment with laterotergite folded under; tergite 2 longer than tergite 3.

Remarks. *Janzophion* is an enigmatic, small Central American genus whose component species, in appearance, resemble members of the Indo-Australian genus *Leptophion*. However, the two genera are probably not closely related, and the similarity between their species may be the result of evolutionary convergence (Gauld, 1985). Both occupy similar habitats. *Janzophion* comprises two species which occur in lower montane environments in Central America. The type-species inhabits cloud-forests in Costa Rica and Panama, and a second species, described below, occurs above 2000 m in northern central Mexico. Nothing is known of the host preferences of these species.

Key to species of *Janzophion*

1 Head quite elongate, with lower face 0.65–0.70 times as broad as long; malar space greater than 0.5 times basal mandibular width (Fig. 55); hind wing with *Rs* weakly bowed (Fig. 57). **nebosus** Gauld (p. 49)

– Head not unusually elongate, with lower face 0.90–0.95 times as broad as long; malar space about 0.3 times basal mandibular width (Fig. 54); hind wing with *Rs* very strongly bowed (Fig. 56) .... **saxis** sp. n. (p. 50)

Janzophion nebosus Gauld

(Figs 7, 55, 57)

Janzophion nebosus Gauld, 1985: 129. Holotype ♂, COSTA RICA (BMNH) [examined].

Description. Head unusually elongate, with lower face polished, 0.65–0.70 times as broad as long; malar space 0.50–0.55 times basal mandibular width; clypeus weakly convex, its margin truncate; head strongly narrowed behind eyes. Antenna slender, flagellum with 66–68 segments, the 20th segment 2.1–2.6 times as long as broad.

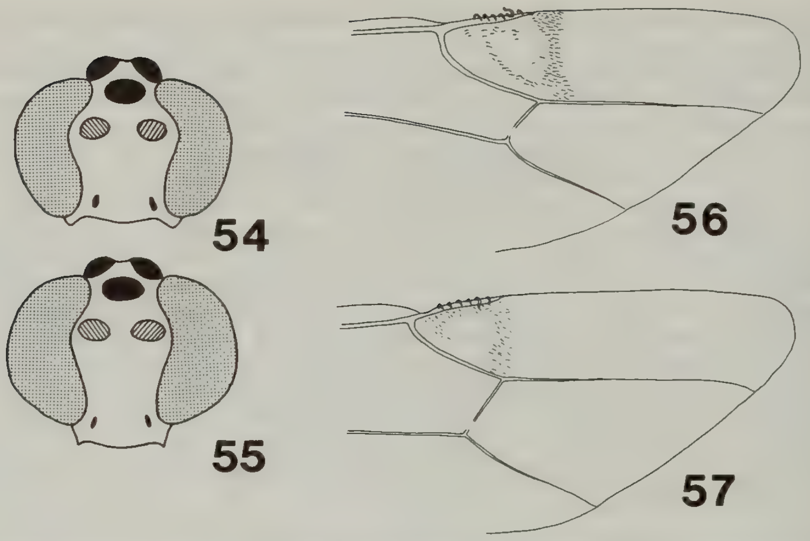
Mesoscutum with margin slightly out-turned; scutellum finely shagreened; mesopleuron with upper part highly polished, finely and sparsely punctate, ventrally slightly more coriaceous; epicnemial carina strong; metapleuron finely punctate, weakly coriaceous. Propodeum in profile evenly declivous.

Fore wing length 14–18 mm; AI = 0.81–1.25; CI = 0.43–0.47; ICI = 0.61–0.72; SDI = 1.14–1.19; marginal cell uniformly hirsute; *1m-cu* sinuous; *cu-a* proximal to base of *Rs&M* by 0.3–0.4 times its own length. Hind wing with *Rs* weakly bowed.

Gaster slender; male subgenital plate bearing long fine pubescence; gonosquama quite long, dorsally somewhat membranous.

Pale yellowish species, with interocellar area, posterior part of mesoscutum, much of mesopleuron, metapleuron and propodeum blackish; gaster with posterior part of tergite 5 and tergites 6+ infuscate. Wing hyaline, pterostigma blackish and membrane adjacent to it infumate.

Remarks. *Janzophion nebosus* is easily recognized by its rather long head, its long malar space and by the weakly curved vein *Rs* in the hind wing. Structurally it is otherwise very similar to *J. saxis*. Both species superficially resemble some species of *Enicospilus*, but they may easily be distinguished by their complete lack of an occipital carina, and by their non-twisted mandibles.



Figs 54–57 *Janzophion* species. 54, 55, head, front view; (54) *J. saxis*; (55) *J. nebosus*. 56, 57, distal part of hind wing; (56) *J. saxis*; (57) *J. nebosus*.

Biological Information. *Janzophion nebosus* is only known to occur in Costa Rica and Panama where it is restricted to humid montane cloud forests between 1500 and 2350 m. In Costa Rica only isolated specimens have been collected (December and February), but at Guadalupe Arriba, in northern Panama, two years light-trapping (1984–5) by H. Wolda yielded the following distributional data:

J	F	M	A	M	J	J	A	S	O	N	D
1	1	5	3	5	3	3	–	–	4	1	4

The host of this species is not known.

Material Examined

Holotype ♂, **Costa Rica**: Alajuela Prov., Volcán Poás National Park, 2350 m, xii.1982 (*Janzen & Hallwachs*) (BMNH)

Paratypes. **Costa Rica**: 1 ♂, same data as holotype (BMNH); 1 ♂, same locality as holotype, xii.1981 (*Janzen & Hallwachs*) (BMNH); 1 ♀, Puntarenas Prov., Monteverde Reserve, 1500 m, ii.1980 (*Mason*) (TC)

Non-type material. **Panama**: 19 ♂, 11 ♀, Chiriqui Prov., Guadalupe Arriba, 2200 m, 1984–5 (*Wolda*) (BMNH, CNC, MNCR, USNM).

Janzophion saxis sp. n.

(Figs 54, 56)

Description. Head not unusually elongate, with lower face polished, 0.90–0.95 times as broad as long; malar space 0.30–0.33 times basal mandibular width; clypeus strongly convex, apically impressed and with margin slightly concave; head moderately strongly narrowed behind eyes. Antenna slender, flagellum with 57–66 segments, the 20th segment about 2.3–2.8 times as long as broad.

Mesoscutum with margin distinctly out-turned; scutellum finely shagreened; mesopleuron with upper part polished, finely coriaceous and sparsely punctate, ventrally slightly more coriaceous; epicnemial carina weak laterally; metapleuron finely punctate, weakly coriaceous. Propodeum in profile rather abruptly declivous.

Fore wing length 14–16 mm; AI = 0.75–0.79; CI = 0.48–0.66; ICI = 0.72–0.78; SDI = 1.05–1.11; marginal cell uniformly hirsute; 1*m-cu* bowed; *cu-a* from subopposite to proximal to the base *Rs&M* by 0.3–0.4 times its own length. Hind wing with *Rs* strongly bowed.

Gaster slender; male subgenital plate with fine decumbent pubescence.

Pale yellowish species, with interocellar area, posterior part of mesoscutum, much of mesopleuron, metapleuron and propodeum blackish; gaster with posterior part of tergite 5 and tergites 6+ slightly infuscate. Wing hyaline, pterostigma blackish and membrane adjacent to it infumate.

Remarks. *Janzophion saxis* is structurally similar to *J. nebosus* except for the differences outlined in the remarks section above.

Biological Information. This species is only known to occur in Durango State, in northern Central Mexico where it has been collected at altitudes between 2300 and 3000 m. Its host is unknown.

Material Examined

Holotype ♀, **Mexico**: Durango, 16 km W. of El Salto, 3000 m, vii.1964 (*Mason*) (CNC)

Paratypes. **Mexico**: 1 ♂ ,3 ♀, same locality as holotype, vi-vii.1964 (*Mason*) (BMNH, CNC); 1 ♀, Durango, 38 km W. La Cuidad, 2300 m, vi.1964 (*Mason*) (CNC).

SICOPHION Gauld

Sicophion Gauld, 1979: 71. Type-species: *Sicophion pleuralis* Gauld, by original designation.

Diagnosis. Black insects with gaster brownish and wings more or less hyaline; fore wing length 16–19 mm. Mandibles twisted about 30° with lower tooth the longer; maxillae slightly lengthened; clypeus subtruncate apically; occipital carina only represented laterally, dorsally and ventrally incomplete. Notauli vestigial; mesopleural furrow transverse, extending from episternal scrobe to near upper end of epicnemial carina; posterior transverse carina of mesosternum present only laterally as vestiges. Fore wing (Fig. 9) with *Rs+2r* curved; *Rs* unusual in that it is dipped centrally; discosubmarginal cell anteriorly with an extensive glabrous area that bears traces of sclerites; pterostigma stout; *1m-cu* curved; hind wing with *Rs* slightly convex, distal abscissa of *Cu*1 basally much closer to *M* than to *1A*. Gaster very slender; second segment with laterotergite narrow, membranous and pendant; tergite 2 slightly longer than tergite 3; female unusual in having the ovipositor proximally angled, apically slender and without a subapical notch.

Remarks. The type-species, *S. pleuralis*, was collected at high altitude in Bolivia. A second, very similar undescribed species occurs at altitudes above 2000 m in Costa Rica and Panama. It is described below.

Sicophion fenestralis sp. n.

(Figs 9, 13)

Description. Mandibles with lower tooth about 1.5 times as long as the upper, apically elongately pointed. Clypeus apically truncate or even slightly concave; head elongate; lower face polished and finely punctate; ocelli very large, the posterior ones contiguous with the eyes. Antenna very long and slender; flagellum with 54–56 segments, the basal segment about 10 times as long as broad.

Mesothorax weakly polished, finely and sparsely punctate; scutellum with lateral carina present on anterior 0.3. Propodeum in profile evenly declivous; anterior transverse carina centrally broadly complete, though laterally not reaching the lateral longitudinal carina; posterior transverse carina from absent to present laterally as weak crests and centrally as small tubercles; lateral longitudinal carina complete, not joined to margin of propodeal spiracle.

Fore wing length 17–19 mm; AI = 1.04–1.25; CI = 0.57–0.92; ICI = 0.83–1.09; SDI = 1.36–1.47; fenestra very large, extending about 0.3–0.4 of way along *Rs+2r*; discosubmarginal cell glabrous in posteroventral corner. Hind wing with 8–9 slender hamuli on *R*1.

Legs slender, otherwise unspecialized.

Gaster very long and slender, with tergites 1–6 longer than posteriorly deep. Male with gonosquama apically elongate, produced into a tapered lobe; aedeagus slightly curved, apically slender and unspecialized.

A predominantly blackish species with flagellum, legs distal to the trochanters, the posterior half of tergite 2 and tergites 3+ brownish, but with apex of gaster slightly infuscate; wings more or less hyaline, pterostigma yellowish brown.

Variation. One male from Guadalupe Arriba has the alitrunk more or less entirely brownish. Both Costa Rica specimens lack vestiges of the posterior transverse carina of the propodeum.

Remarks. *Sicophion fenestralis* differs from the type-species of the genus in having a larger fenestra and a more strongly angulate *Rs+2r*, slightly more extensive scutellar carinae, an almost complete anterior transverse carina of the propodeum, a slightly longer lower mandibular tooth, and most usually in having the first segment of the gaster entirely black and the femora brownish. *S. pleuralis* has a smaller fenestra that only extends about 0.1 of the way along *Rs+2r*, and has this vein less conspicuous bent, and then so nearer its base. *S. pleuralis* also has very short scutellar carinae, only has a vestige of the anterior transverse carina of the propodeum discernible centrally, has the lower tooth of the mandible only slightly the longer, has the anterior part of tergite 1 yellow, and has blackish femora.

Biological Information. *Sicophion fenestralis* has been collected in Panama and Costa Rica, where it is only known to occur at sites between 2200 and 2500 m. It occurs sympatrically and synchronously with *Janzophion nebosus* and some species of *Ophion*. At Guadalupe Arriba, Panama, *S. fenestralis* has the following seasonal distribution (based on light-trap catches for 1984–5):

J	F	M	A	M	J	J	A	S	O	N	D
1	3	2	6	2	5	12	5	8	6	2	1

Nothing is known of the hosts of *S. fenestralis*. The ovipositor of this species is quite unlike that of any other genus of ophionine, and obviously highly modified for a certain function. What this function is will not be understood until the host of this insect is discovered.

Material Examined

Holotype ♀, **Panama**: Chiriqui, Guadalupe Arriba, 2200 m, xii.1984-i.1985 (*Wolda*) (BMNH).

Paratypes. **Costa Rica**: Alajuela Prov.: 1 ♂, Volcán Poás National Park, 2350 m, xii.1981 (*Janzen & Hallwachs*) (BMNH): San José Prov.: 1 ♀, San Gerardo de Dota, Cerro de la Muerte, 2430 m, xii.1981 (*Janzen & Hallwachs*) (BMNH). **Panama**: 35 ♂, 17 ♀, Chiriqui, Guadalupe Arriba, 2200 m, 1984–85 (*Wolda*) (BMNH, CAS, CNC, MCZ, MNCR, PANS, TC, USNM, ZIL).

The *EREMOTYLUS* genus-group

EREMOTYLUS Foerster

Eremotylus Foerster, 1869: 150. Type-species: *Ophion marginatus* Gravenhorst (= *Anomalon marginatum* Jurine), by subsequent monotypy, Thomson, 1888: 1193.

Camptoneura Kriechbaumer, 1901*a*: 23. Type-species: *Ophion marginatus* Gravenhorst (= *Anomalon marginatum* Jurine), by subsequent designation, Viereck, 1914: 27. [Junior homonym of *Camptoneura* Agassiz, 1846.]

Genophion Felt, 1904: 123. Type-species: *Genophion gilletti* Felt (= *Ophion costale* Cresson), by original designation.

Camptoneuroides Strand, 1928: 52. [Replacement name for *Camptoneura* Kriechbaumer.]

Clistorapha Cushman, 1947: 450. Type-species: *Ophion subfuliginosus* Ashmead, by original designation.

Boethoneura Cushman, 1947: 451. Type-species: *Boethoneura arida* Cushman, by original designation.

Chilophion Cushman, 1947: 454. Type-species: *Ophion abnormum* Felt, by original designation.

Chlorophion Townes, 1971: 55. Type-species: *Chlorophion vitripennis* Townes, by original designation.

Diagnosis. Predominantly orange-brown insects with hyaline wings; fore wing length 9–17 mm. Mandibles not twisted but usually apically narrow; maxillae and labium unspecialized; clypeus rather flat, apically blunt, often slightly concave; occipital carina more or less complete. Notauli anteriorly weakly impressed; mesopleural furrow vestigial; posterior transverse carina of mesosternum present or absent. Fore wing (Fig. 22) with *Rs+2r* basally abruptly curved and thickened; discosubmarginal cell with a glabrous area anteriorly; pterostigma quite broad; 1*m-cu* curved to sinuous; hind wing with *Rs* usually bowed; distal abscissa of *Cu*1 more or less equidistant between *M* and 1*A*. Fore tibial spur with membranous flange behind comb. Gaster moderately slender to slender; second segment with laterotergite folded under; tergite 2 subequal to or slightly longer than tergite 3.

Remarks. *Eremotylus* is a moderately large genus, which is most species-rich in semi-arid habitats, though a few species are widely distributed throughout the Holarctic realm. The centre of diversity of the genus appears to be the Mediterranean Basin in the Old World, and the south-western United States/northern Mexico in the New World. *Eremotylus* is represented in Central America by at least four species, *E. arida* (Cushman), *E. subfuliginosus* (Ashmead) and two undescribed species. Three of these are only known to occur in the drier parts of north and northern central Mexico, but one distinctive species, which is described below, occurs in Chiapas State in tropical southern Mexico. No hosts are recorded for Central American species, but one European species is known to parasitize a noctuid larva (Seyrig, 1926).

Eremotylus tropicus sp. n.

(Fig. 22)

Description. Mandibles stout, long, weakly tapered and with the upper tooth very slightly the longer; outer mandibular surface with a distinct proximal concavity; malar space 0.2–0.3 times basal mandibular width. Clypeus in front view 2.1–2.3 times as broad as long, apically slightly protuberant and with margin thin; face subquadrate, coarsely and closely punctate centrally but more sparsely and coarsely punctate on clypeus. Head in dorsal view with genae long, weakly rounded behind eyes in females, in male slightly inflated; ocelli large, the posterior ones almost contiguous with the margin of the eye. Occipital carina complete, ventrally joining the hypostomal carina some distance from the base of the mandible. Antenna very long and slender; flagellum with 63–65 segments; central segments 1.8–2.0 times as long as broad.

Mesoscutum anteriorly rather irregularly rounded; notauli distinct near anterior scutal margin; scutellum with more or less complete lateral longitudinal carinae which are strongly convergent posteriorly. Mesopleuron coarsely and rather sparsely punctate; epicnemial carina weak, but present laterally; metapleuron very weakly convex, coarsely and sparsely punctate; posterior transverse carina of mesosternum only represented by lateral vestiges. Propodeum long, in profile evenly declivous; anterior transverse carina discernible laterally as vestiges, the posterior transverse carina more or less absent; anterior are unusually long (for a species of *Eremotylus*); posterior part of propodeum rather weakly and irregularly rugose; lateral longitudinal carina complete.

Fore wing length 16–17 mm; alar pubescence fine and dense (normal for an ophionine); 1*m-cu* rather unevenly curved, without a trace of a vein stub centrally; *cu-a* subopposite the base of *Rs&M*. Hind wing with 7–8 hamuli on *R*1; first abscissa of *Rs* strongly curved; marginal cell sparsely hirsute proximally.

Legs slender and unspecialized; mid tibia with spurs slender, the longer 1.2–1.3 times the length of the shorter; tarsal claws long and weakly curved, those of the female coarsely and closely pectinate, those of the male more finely and closely pectinae.

Gaster long and very slender; tergite 2 in profile more than 5 times as long as posteriorly deep; thyridia elliptical, separated from anterior margin of tergite by about own length; tergite 3 distinctly longer than posteriorly deep. Female with ovipositor unspecialized. Male with terminal sternites with fine unspecialized pubescence; apex of gonosquama produced slightly and obliquely truncate; aedeagus apically rounded.

An orange-brown species with extreme posterior apex of gaster blackish. Wings very weakly and evenly infumate.

REMARKS. This is the only tropical American species of *Eremotylus* and structurally it is one of the most distinctive species in the genus. The other Mexican species of *Eremotylus* are smaller and stouter with slender mandibles, and very short anterior propodeal areas. Usually they have short, sparse alar pubescence and are more uniformly reddish brown in colour.

BIOLOGICAL INFORMATION. *Eremotylus tropicus* is only known to occur in Chiapas, Mexico where individuals have been collected at an altitude of about 1000 m during June.

MATERIAL EXAMINED

Holotype ♀, **Mexico**: Chiapas, 32–40 km N. Huixtla, 1000 m, vi.1969 (*Peterson*) (CNC)

Paratypes. **Mexico**: 1 ♂, same data as holotype (CNC); 2 ♀, Chiapas, 32 km N. Huixtla, 1000 m, vi.1969 (*Mason*) (BMNH, CNC).

The *THYREODON* genus-group

RHYNCHOPHION Enderlein

Rhynchophion Enderlein, 1912: 630. Type-species: *Rhynchophion odontandroplax* Enderlein, by original designation.

DIAGNOSIS. Large, stout, dark-coloured insects with violet or orange wings; fore wing length 18–29 mm. Mandible stout, not twisted; maxillae and labium lengthened, projecting by a distance equal to about half length of head (Fig. 17); clypeus apically slightly pointed; occipital carina more or less complete. Notauli vestigial; mesopleural furrow horizontal; unusual in that epicnemial carina does not extend laterally up mesopleuron; posterior transverse carina of mesosternum present only laterally as vestiges. Fore wing with *Rs+2r* almost straight; discosubmarginal cell evenly hirsute; pterostigma slender; 1*m-cu* curved; hind wing with *Rs* almost straight; distal abscissa of *Cu*1 basally closer to *M* than to 1*A*. Fore tibial spur without a membranous flange behind the comb. Gaster stout (Fig. 20); second segment with laterotergite folded under; tergite 2 shorter and in profile much smaller than tergite 3.

REMARKS. *Rhynchophion* is a small genus that comprises only three nominal species (Townes & Townes, 1966). Their cumulative range extends from the southern United States to southern Brazil. Only one, *R. flammipennis* (Ashmead), occurs in Mesoamerica.

Rhynchophion flammipennis (Ashmead)

(Figs 17, 20)

Thyreodon flammipennis Ashmead, 1894: 125. Holotype ♀, MEXICO: Baja California (CAS) [examined].
Rhynchophion flammipennis (Ashmead) Townes, 1945: 746.

Description. Lower tooth of mandible stouter and slightly longer than the upper tooth; lower face about 0.8 times as broad as long, closely and coarsely punctate; ocelli small, the posterior ones separated from eye margins by more than their maximum diameter. Antenna stout, with 55–60 flagellar segments, the central segments transverse.

Pronotum mediodorsally flat, unspecialized; mesoscutum, mesopleuron and metapleuron coarsely and closely punctate; metanotum laterally inflated. Propodeum without distinct transverse carinae, rather coarsely coriaceous.

Fore wing covered with dense fine pubescence; marginal cell narrow, short; *cu-a* subopposite to the base of *Rs&M*; hind wing with 12–14 closely spaced hamuli on *R*1.

Legs stout, fore tibia flattened; fore and mid tarsal claws long, evenly curved and with short close pectinae; hind tarsal claws more abruptly curved and with a longer apical point.

Gaster exceptionally stout; hind margin of strongly sclerotized part of sternite 1 (the part fused with the tergite) anterior to the level of the spiracles; tergites 3+, in profile , posteriorly deeper than dorsally long. Female subgenital plate strongly sclerotized, longer than preceding sternite; male subgenital plate very short, with hind margin concave.

A black species with antennae from black to bright yellowish; wings (of Costa Rica specimens) yellowish, basally and apically blackish.

Remarks. *Rhynchophion flammipennis* is easily distinguished from all other ophionines in Mesoamerica by its very stout appearance. However, it may not be recognized as an ophionine unless its venation is closely examined

Biological Information. This is a widespread insect whose range extends from southern Arizona to Ecuador. I have only seen it from two localities in Costa Rica, Santa Rosa National Park, and Casa Maritza at an altitude of 700 m on the lower western slopes of Volcán Orosi. In Santa Rosa National Park, *R. flammipennis* has occasionally been collected in Malaise traps during earlier months of the wet season (June/August). In flight and colour pattern *R. flammipennis* mimics species of the pompilid genus *Pepsis*. *Rhynchophion* species are diurnally active and may be observed feeding on flowers. They are not known to come to light. The hosts are not known, but species of the closely related Old World genus *Dictyonotus* parasitize sphingid larvae (Gauld, 1985).

Material Examined

Holotype ♀, **Mexico**: Baja California, El Taste, 1100 m (CAS).

16 ♂, 13 ♀, from the following localities: **Costa Rica** (Guanacaste); **Ecuador; Mexico** (Baja California, Durango, Guerrero, Oaxaca); **Nicaragua; U.S.A.** (Arizona, New Mexico) (BMNH, CNC, TC, USNM).

THYREODON Brullé

Thyreodon Brullé, 1846: 150. Type-species: *Thyreodon cyaneus* Brulle, by subsequent designation, Hooker, 1912: 107.
Athyreodon Ashmead, 1900*a*: 87. Type-species: *Athyreodon thoracicus* Ashmead (= *Ophion atriventris* Cresson), by original designation.
Tipulophion Kriechbaumer, 1901*b*: 75. Type-species: *Tipulophion gigas* Kriechbaumer (= *Ophion atriventris* Cresson), by monotypy.
Macrophion Szépligeti, 1905: 32. Type-species: *Macrophion ornatus* Szépligeti (= *Ophion atriventris* Cresson), by subsequent designation, Viereck, 1912: 640.
Oleter Shestakov, 1926: 259. Type-species: *Oleter selenaction* Shestakov (= *Thyreodon laticinctus* Cresson), by original designation.

Diagnosis. Generally large black, orange and black or yellow and black species with infumate or mottled wings; fore wing length 16–28 mm. Mandible stout, not twisted; maxillae and labium unspecialized; clypeus apically slightly pointed; occipital carina mediodorsally complete. Pronotum unusual in having the anterior margin mediodorsally curved up, closely co-adapted with occiput, and often with a transverse keel behind this flange; notauli weak to very strong and long; mesopleural furrow weak, but if discernible then extending from episternal scrobe to subalar prominence; posterior transverse carina represented by lateral and central vestiges; propodeum unusual in being strongly inflated and in side view dwarfing the metapleuron. Fore wing with *Rs+2r* curved basally, otherwise straight; discosubmarginal cell with or without a small glabrous area anteriorly; pterostigma very slender; *1m-cu* bowed; hind wing with *Rs* straight or weakly bowed; distal abscissa of *Cu*1 basally either very much closer to *M* than to *1A* or actually arising from *M*. Fore tibial spur without a membranous flange behind the comb. Gaster from slender to moderately stout; second segment with laterotergite pendant; tergite 2 longer than tergite 3.

REMARKS. *Thyreodon* is an American genus that contains about 40 large and conspicuous species. The majority are restricted to tropical America, but approximately five species occur in the southern part of the United States and one species, *T. atricolor* (Olivier), occurs as far north as southern Canada (Carlson, 1979). *Thyreodon* species are generally believed to be parasitoids of sphingids (Townes, 1971), but very few species have actually ever been reared, and one that has attacks saturniids

Unlike most other ophionines many *Thyreodon* species are, at least to some extent, diurnally active and can be encountered during the day flying in forest clearings or feeding from flowers. Like other diurnal ichneumonids (Gauld, 1987), *Thyreodon* species are probably exposed to a variety of predators, particularly asilids which may be very common in their forest habitats, and therefore it is not surprising to find that they have a defence against these predacious dipterans. Their pronotum is modified dorsally, furnished with keels and curved forward to reach the concave occiput, thus providing the cervical region (which is the part asilids try to penetrate) with a substantial and effective shield

Although many *Thyreodon* species are diurnally active insects, and like other diurnal ichneumonids have small ocelli and eyes, some apparently are predominantly nocturnal and have enlarged ocelli and eyes. Some authors (Cushman, 1947; Porter, 1984) have placed the nocturnal species in a separate genus, *Athyreodon*. However, the diurnal and nocturnal species share a set of autapomorphic features that characterize them as a monophyletic lineage of Ophioninae (see Gauld, 1985) and I concur with Townes (1971) and suggest that the differences between the two groups are best expressed by according them the status of species-groups within a single genus, *Thyreodon*. This is concomitant with the general classification of the subfamily as a whole, as several other ophionine genera (e.g. *Ophion*, *Enicospilus*) include morphologically rather aberrant species which are diurnally active. Both species-groups are represented in Central America.

The *Thyreodon atriventris* species-group (= *Athyreodon*) is characterized by having very large ocelli which touch or almost touch the margin of the eye, so that at most the orbital ocellar distance is less than 0.5 times as long as the maximum ocellar diameter. This species-group includes five described Mesoamerican taxa, *T. atriventris* (Cresson), which is widespread from tropical Mexico south to Panama and thence throughout much of tropical South America, *T. flammiger* Morley from Jamaica, *T. fulvescens* Cresson, which is endemic to Cuba, *T. maculipennis* Cresson, whose range extends from Mexico south to Panama, and *T. rivinae* Porter which is known from Costa Rica and the southern U.S.A. I have seen one additional and apparently undescribed species that occurs in Costa Rican forests.

The *Thyreodon laticinctus* species-group (= *Thyreodon* s.s.) is characterized by having small ocelli, with the orbital ocellar distance equal to or greater than the maximum ocellar diameter. This species-group has been subdivided by Cushman (1947) and Porter (1984) into two lineages, the *laticinctus* subgroup and the *atricolor* subgroup. The Mesoamerican species of the former subgroup have recently been revised by Porter (1984) who recognized 10 species as occurring in the area: *T. apricus* Porter, whose range extends from Texas south to Costa Rica; *T. elegans* Cresson [Cuba]; *T. erythrocera* Cameron [Arizona, Mexico, Costa Rica]; *T. ferrugineus* Hooker [Mexico]; ; *T. grandis* Cresson [Cuba, Jamaica]; *T. laticinctus* Cresson [Belize, Bolivia, Colombia, Costa Rica, Guatemala, Honduras, Mexico, Nicaragua, Panama, Peru, Trinidad]; *T. morosus* Smith [Brazil, Costa Rica, Mexico, Panama, Peru]; *T. niger* Cresson [Guatemala, Mexico]; *T. robur* Porter [Mexico]; *T. ultor* Porter [Bahamas, Cuba]. The *atricolor* subgroup is represented in Mesoamerica by five described species, *Thyreodon affinis* Cresson [Cuba]; *T. bicolor* Morley [Central America?]; *T. fernaldi* Hooker [Mexico, southern U.S.A.]; *T. ornatipennis* Cresson [Mexico, southern U.S.A.]; *T. santarosae* Porter [Costa Rica] (Townes & Townes, 1966; Porter, 1986). Only the species of *Thyreodon* that occur in Costa Rica have been studied by me, and a synopsis of them is presented below.

The Costa Rican species of *Thyreodon*

Fairly extensive collecting has revealed the existence of nine species of *Thyreodon* in Costa Rica, though others may yet be discovered, especially in the wet forests on the eastern side of the country. The key given below should therefore be used with caution and, as far as possible, identifications should be verified by comparison with authenticated specimens. The keys and descriptions presented by Porter (1980; 1984;

1986) are also very informative. However, the simplified key given here will permit the most frequently encountered Costa Rica species to be recognized and some further critical features that will enable recognition are referred to under the species headings below.

1 Ocelli very large, touching or almost touching the margin of the eye, at most with orbital-ocellar distance 0.5 times as long as maximum ocellar diameter (Figs 63–64) ... 2

– Ocelli small, separated from the margin of the eye by a distance that is at least equal to maximum ocellar diameter (Fig. 62) ... 6

2 Alitrunk orange-brown; fore wings hyaline, with large blackish areas in basal and marginal cells. Notauli broad and weakly impressed (Fig. 65) ... ***atriventris*** (Cresson) (most) (p. 56)

– Alitrunk black or very dark brown; fore wings entirely black, or black with a central hyaline circular area ... 3

3 Notauli broad and weakly impressed on anterior part of mesopleuron (Fig. 65); propodeum with a very strong tubercle just behind upper end of spiracle. ***atriventris*** (Cresson) (dark morph) (p. 56)

– Notauli rather narrow but strongly impressed (Fig. 66); propodeum with a weak or indistinct crest or tubercle just behind upper end of spiracle ... 4

4 Posterior ocelli separated from eye margin, the orbital- ocellar distance about 0.3 times maximum ocellar diameter (Fig. 64); antenna blackish and fore wing with a central hyaline area ***maculipennis*** Cresson (p. 59)

– Posterior ocelli contiguous or almost contiguous with the eye margin (Fig. 63); either with antenna bright yellow, or with fore wing entirely black ... 5

5 Antenna bright yellow; fore wing with a central hyaline area; hind femur with distal 0.5 stout and slightly compressed (Fig. 61) ... ***rivinae*** Porter (p. 60)

– Antenna black; fore wing uniformly blackish; hind femur very slender, cylindrical throughout (Fig. 60) ... species 1 (p. 60)

6 Propodeum posterodorsally smooth and highly polished; wings generally centrally somewhat hyaline, basally and apically strongly infumate ... ***santarosae*** Porter (p. 61)

– Propodeum posterodorsally coarsely reticulate, rugose or coriaceous, variously polished; wings uniformly black ... 7

7 Propodeum posterodorsally with a very strongly impressed median longitudinal furrow that is laterally bordered by broad shallow furrows posteriorly (Fig. 67); anterior end of notaulus with a transverse raised crest (Fig. 69) ... ***apricus*** Porter (p. 61)

– Propodeum posterodorsally with a broad, shallow median longitudinal furrow, laterally without secondary furrows (Fig. 68); anterior end of notaulus either without a crest, or if a crest is discernible then it is weak and parallel to notaulus (Fig. 70) ... 8

8 Occipital carina ventrally joining the hypostomal carina (Fig. 58); posterior part of propodeum coriaceous ... ***erythrocera*** Cameron (p. 62)

– Occipital carina ventrally incomplete, not reaching the hypostomal carina (Fig. 59); posterior part of propodeum generally with strong oblique wrinkles ... 9

9 Gaster black with segments 3–4 predominantly bright yellowish or orange; flagellum entirely black ... ***laticinctus*** Cresson (p. 62)

– Gaster entirely black; flagellum with proximal 0.6 white or whitish yellow, only distal apex blackish ... ***morosus*** Smith (p. 63)

Thyreodon atriventris (Cresson)

(Figs 16, 65)

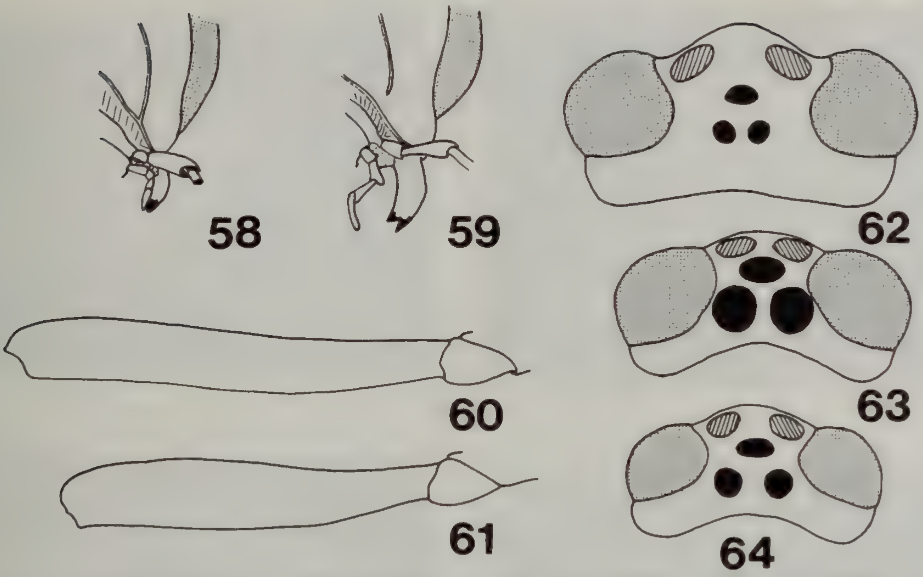
Ophion atriventris Cresson, 1874: 374. Holotype ♀, MEXICO (PANS) [examined].

Thyreodon rufothorax Cameron, 1886: pl. 12. Holotype ♀, PANAMA (BMNH) [examined]. [Synonymized by Hooker, 1912: 102.]

Thyreodon rufithorax Cameron; Cameron, 1886: 290. [Mis-spelling.]

Athyreodon thoracicus Ashmead, 1900*a*: 87. Holotype ♀, ECUADOR (USNM) [examined]. [Synonymized by Hooker, 1912: 102.]

Thyreodon grenadensis Ashmead, 1900b: 270. Holotype ♀, GRENADA (BMNH) [examined]. [Synonymized by Townes & Townes, 1966: 186.]



Figs 58–64 *Thyreodon* species. 58, 59, head, posteroventral view; (58) *T. erythrocera*; (59) *T. morosus*. 60, 61, hind femur; (60) *Thyreodon* sp. 1; (61) *T. rivinae*. 62–64, head, dorsal view; (62) *T. laticinctus*; (63) *T. rivinae*; (64) *T. maculipennis*.

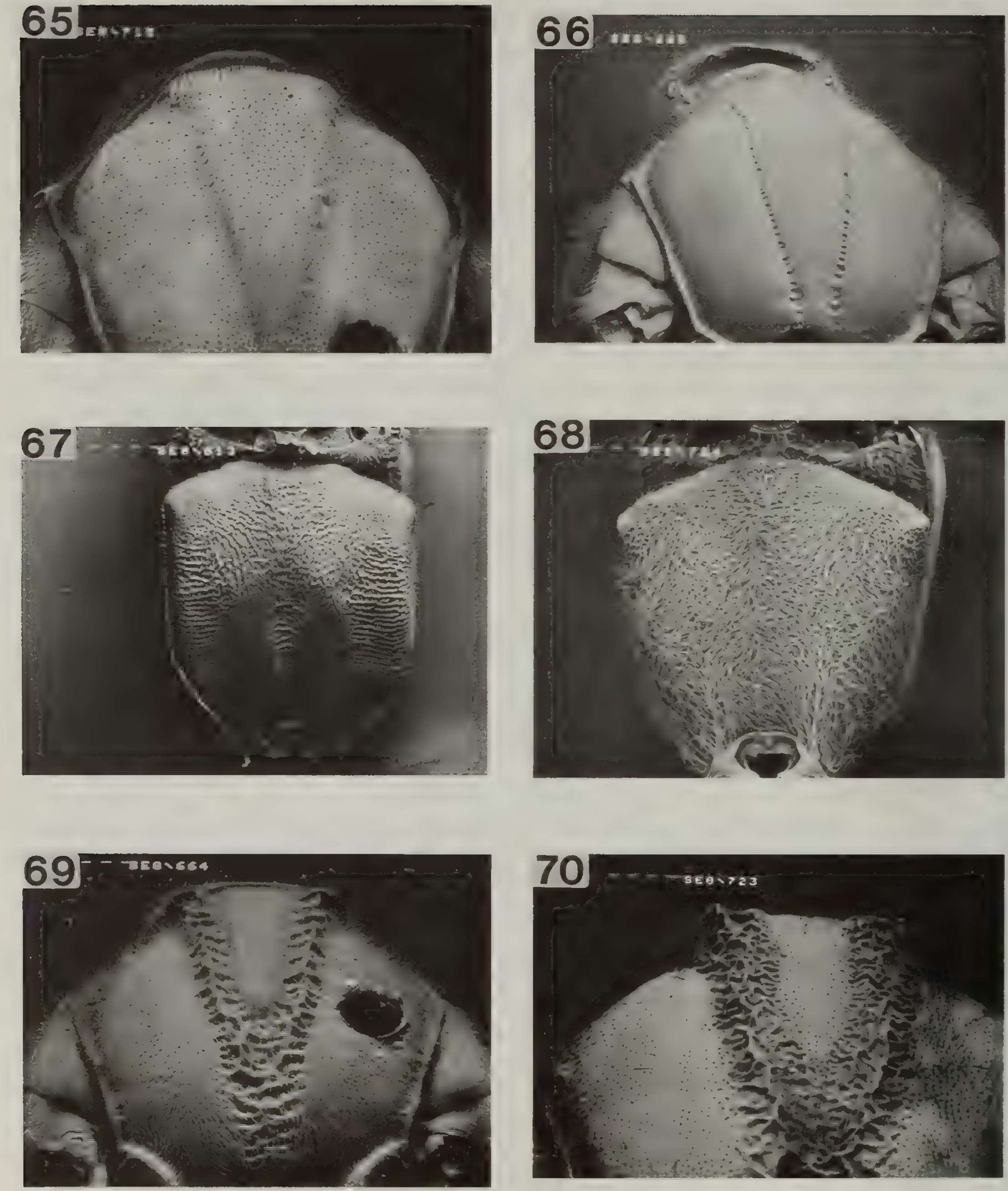
Tipulophion rufithorax (Cameron) Schulz, 1903: 249. [Mis-spelling.]
Macrophion ornatus Szépligeti, 1905: 33. Holotype ♂, BELIZE (TM). [Synonymized by Morley, 1912: 15.]
Athyreodon atriventris (Cresson) Hooker, 1912: 102.
[*Macrophion fulvescens* (Cresson) Morley, 1912: 14. Misidentification.]
Macrophion grenadensis (Ashmead) Morley, 1912: 15.
Thyreodon atriventris (Cresson) Townes & Townes, 1966: 186.

Diagnosis. Head, alitrunk and most of anterior two pairs of legs usually orange-brown; interocellar area, flagellum, gaster and most of hind legs black; wings hyaline, fore wing with basal and marginal cells partly infumate. Ocelli very large, the hind ones contiguous with the eyes; genae strongly constricted behind eyes; occipital carina ventrally incomplete, not turned towards hypostomal carina. Mesoscutum with notauli broad but weakly impressed, without an anterior crest (Fig. 65); mesopleuron finely and usually closely punctate; propodeum usually extensively coarsely reticulate, with prominent median and lateral tubercles, and posterodorsally with an indistinct median longitudinal furrow. Fore wing length 21–29 mm. Hind femur moderately slender, cylindrical. Gaster stout, tergite 2 less than 2 times as long as posteriorly deep; male with gonosquama apically subtruncate, with an elongate spine-like projection dorsally.

Variation. Large numbers of individuals agree closely with the above description, but I have seen a number of aberrant individuals in Costa Rica which may represent distinct species. A female from Braulio Carrillo National Park is entirely black and has the wings strongly infumate except for a central hyaline band. A male from Corcovado National Park resembles typical specimens except that the gonosquamae are evenly but elongately tapered distally, and lack the spine-like process. A few individuals from Santa Rosa National Park are exceptionally small (fore wing length 17–18 mm), have the propodeum centrally striate rather than reticulate, lack a median propodeal tubercle and have a short, upcurved process on the distal apex of the gonosquama. The status of these morphs requires further investigation.

Remarks. *Thyreodon atriventris* is most easily recognized by its colour pattern, large size and the large ocelli. The dark morph may be separated from other species in the *atriventris* species-group by its weakly impressed notauli, robust gaster and large size.

Biological Information. *Thyreodon atriventris* is one of the most common and conspicuous species of the genus in lowland and lower montane forest sites in Costa Rica and Panama. Occasional individuals may be encountered during the day, and specimens have been observed on the flowers of *Forsteronia spicata* (Apocynaceae) in Santa Rosa National Park, Costa Rica. However, *T. atriventris* appears principally to be



Figs 65–70 *Thyreodon* species. 65, 66, mesoscutum, dorsal view; (65) *T. atriventris*; (66) *T. maculipennis*. 67–68, propodeum, dorsal view; (67) *T. apricus*; (68) *T. laticinctus*. 69, 70, mesoscutum, dorsal view; (69) *T. apricus*; (70) *T. laticinctus*.

a nocturnally active species and specimens are frequently attracted to light. In Santa Rosa National Park it is common throughout most of the wet season (late May-December) and pooled seasonal distributional data from 1981–6 are:

J	F	M	A	M	J	J	A	S	O	N	D
–	–	–	–	10	15	4	1	5	4	3	–

On Barro Colorado Island, Panama, it seems to be less seasonal as individuals have been taken in light-traps by Dr H. Wolda most months of the year. The cumulative seasonal distributional data for 1983–5 are:

J	F	M	A	M	J	J	A	S	O	N	D
9	7	3	1	17	4	3	2	–	1	5	1

T. atriventris has been reared by Dr D. H. Janzen from several species of sphingid caterpillars in Santa Rosa National Park, but most commonly from *Pachylia ficus* (Linnaeus) whose larvae feed on a variety of arborescent Moraceae (Janzen, 1984*a*).

MATERIAL EXAMINED

Holotype ♀ (*Ophion atriventris* Cresson), **Mexico**: Orizaba (PANS). Holotype ♀ (*Thyreodon rufothorax* Cameron), **Panama**: Bugaba, 300–500 m (BMNH). Holotype ♀ (*Athyreodon thoracicus* Ashmead), **Ecuador** (USNM). Holotype ♀ (*Thyreodon grenadensis* Ashmead), **Grenada**: Baltasar, on windward side (BMNH).

Costa Rica: Guanacaste Prov.: 1 ♀, 5 km NE. of Quebrada Grande, 600 m, vi.1986 (*Gauld*) (BMNH); 1 ♂, Rincon de la Vieja National Park, Mirador, 900 m, iii.1984 (*Gauld*) (BMNH); 1 ♂, 4 km W. Santa Cecilia, 300 m, iv.1983 (*Janzen & Hallwachs*) (BMNH); 17 ♂, 25 ♀, Santa Rosa National Park, 300 m, dates as above (*Janzen, Hallwachs & Gauld*) (BMNH; MNCR); 3 ♂, 3 ♀, Volcán Orosi, Casa Mariksa [=Maritza], 800 m, vi-vii.1986 (*Gauld*) (BMNH): Heredia Prov.: 1 ♀, Finca La Selva, 3 km S. Puerto Veijo, vii.1982 (*Hespenheide*) (BMNH): Limón Prov.: 1 ♂, Tortuguero National Park, Cerro Tortuguero, 0–100 m, v.1984 (*Janzen & Hallwachs*) (BMNH): Puntarenas Prov.: 4 ♂, 5 ♀, Corcovado National Park, Osa Peninsula, i-v. 1981–7 (*Janzen & Hallwachs*) (BMNH); 1 ♂, 2 ♀, same locality, 20 m, v.1984 (*Gauld*) (BMNH); 1 ♂, 4 ♀, Fila Esquinas, 35 km S. Palmar Norte, 150 m, i.1983 (*Janzen & Hallwachs*) (BMNH): San José Prov.: 1 ♂, 1 ♀, Braulio Carrillo National Park, Estacion Carrillo, 700 m, vii.1984, v.1985 (*Chacon*) (BMNH). **Panama**: 1 ♂, Barro Colorado Island, ix.1967 (*Sexton*) (UM); 25 ♂, 28 ♀, Barro Colorado Island, 120 m, dates as above (*Wolda*) (BMNH).

Other specimens. **Costa Rica**: Guanacaste Prov.: 1 ♂, 1 ♀, [small morph], Santa Rosa National Park, 300 m, v.1983 (*Janzen & Hallwachs*) (BMNH): Puntarenas Prov.: 1 ♂, [pointed gonosquama morph], Corcovado National Park, iii.1978 (*Janzen*) (BMNH); San José Prov.: 1 ♀, [dark morph], La Montura, Braulio Carrillo National Park, 1100 m, xii.1981 (*Janzen & Hallwachs*) (BMNH).

Thyreodon maculipennis Cresson

(Figs 64, 66)

Thyreodon maculipennis Cresson, 1874: 375. Lectotype ♀, MEXICO, designated by Townes & Townes (1966: 189) (PANS) [examined].

DIAGNOSIS. A uniformly black or blackish species; wings blackish, fore wing with a central hyaline circular area. Ocelli moderately large, the hind ones separated from the eyes by about 0.3 times their maximum diameter; genae rounded behind eyes; occipital carina ventrally incomplete, not turned towards hypostomal carina. Mesoscutum with notauli narrow but strongly impressed (Fig. 66), almost meeting each other before the scuto-scutellar groove, without an anterior crest; mesopleuron smooth, with isolated fine punctures; propodeum extensively irregularly reticulately wrinkled, with indistinct median and lateral tubercles, and posterodorsally with a broad shallow median longitudinal furrow. Fore wing length 18–20 mm. Hind femur moderately slender, distally weakly compressed. Gaster moderately stout, tergite 2 about twice as long as posteriorly deep; male with gonosquama apically elongately tapered, slightly upcurved.

REMARKS. *Thyreodon maculipennis* can most easily be recognized by its colour pattern and its moderately large ocelli. It is most likely to be confused with *T. rivinae* and species 1, but can readily be distinguished by the characteristics given in the key.

BIOLOGICAL INFORMATION. *Thyreodon maculipennis* seems to be associated with seasonally dry forests. In Costa Rica it has only been collected in or near to Santa Rosa National Park, frequently at light, although individuals may sometimes be found feeding on flowers during the day. *T. maculipennis* has been collected throughout the wet season (late May to December) though it seems to be most common in June and November, suggesting it may have two generations a year. The cumulative totals for its seasonal distribution in 1983–6 are:

J	F	M	A	M	J	J	A	S	O	N	D
–	–	–	–	–	20	7	2	–	1	10	1

Specimens have been reared by Dr D. H. Janzen from the larvae of the medium small sphingids *Perigonia lusca* (Fabricius) and *Xylophanes turbata* (Edwards) which feed on some arborescent Rubiaceae (Janzen, 1984*a*).

MATERIAL EXAMINED

Lectotype ♀, **Mexico**: Orizaba (PANS); paralectotype ♂, Mexico: Cordoba (PANS).

Costa Rica: Guanacaste Prov.: 1 ♀, 2 km E. Cuajiniquil, 300 m, vi.1986 (*Gauld*) (BMNH); 20 ♂, 21 ♀, Santa Rosa National Park, 300 m, vi-viii, x-xii.1983–6 (*Janzen, Hallwachs & Gauld*) (BMNH, MNCR).

Thyreodon rivinae Porter

(Figs 19, 61, 63)

Thyreodon rivinae Porter, 1980: 243. Holotype ♀, U.S.A.: Texas (FSCA).

DIAGNOSIS. An entirely black or blackish species except for the antenna which is bright yellow; wings blackish, fore wing with a central hyaline circular area. Ocelli very large, the hind ones contiguous with the eyes; genae rounded behind eyes; occipital carina ventrally incomplete, not turned towards hypostomal carina. Mesoscutum with notauli strongly impressed, almost meeting before the scuto-scutellar groove, without a crest anteriorly; mesopleuron smooth with fine, very sparse punctures; propodeum extensively rather finely reticulate, with indistinct median and lateral tubercles, posterodorsally with a broad shallow median longitudinal furrow. Fore wing length 17–19 mm. Hind femur moderately stout, the distal 0.5 laterally compressed. Gaster moderately stout, tergite 2 about twice as long as posteriorly deep.

REMARKS. *Thyreodon rivinae* is, to a large extent, sympatric with and resembles *T. maculipennis*, but may be distinguished by its bright yellow antennae. Furthermore, the posterior ocelli of *T. rivinae* are contiguous with the eye margin whereas those of *T. maculipennis* are separated from the eye margin by about 0.3 times the ocellar diameter.

BIOLOGICAL INFORMATION. *Thyreodon rivinae* is known to occur in Hidalgo county in the extreme south of Texas, and in north-western Costa Rica, so it is probably widely distributed throughout Central America. The single specimen from Texas was collected in July (a hot and dry period) in shady *Celtis* woodland flying over a patch of the herb *Rivina humilis* (Phytolaccaceae) (Porter, 1980). In Costa Rica *T. rivinae* appears to be associated with seasonally dry forests and it has only been collected in Santa Rosa National Park. [It is perhaps noteworthy that *Rivina humilis* also occurs in Santa Rosa (Janzen & Liesner, 1980).] Individuals are attracted to light, but it is rather less commonly encountered than *T. maculipennis*. All the individuals of *T. rivinae* that I have seen were collected in June or early July.

MATERIAL EXAMINED

Costa Rica: Guanacaste Prov.: 1 ♀, Santa Rosa National Park, 300 m, vi.1980 (*Janzen & Hallwachs*) (BMNH); same locality, 1 ♀, vi.1984 (*Janzen & Hallwachs*) (BMNH); same locality, 2 ♀, vi.1985, 1 ♀, vii.1986 (*Gauld*) (BMNH, MNCR).

Thyreodon species 1

(Fig. 60)

DIAGNOSIS. A highly polished jet-black species; wings uniformly blackish. Ocelli quite large, the hind ones of the female more or less contiguous with the eyes, those of the male separated from the eye margin by about 0.1 of the maximum ocellar diameter; genae constricted behind eyes; occipital carina ventrally incomplete, not turned towards hypostomal carina. Mesoscutum with notauli very strongly impressed, virtually meeting before scuto-scutellar groove, without an anterior crest; mesopleuron smooth with very sparse, fine punctures; propodeum extensively reticulate, centrally tending to irregularly longitudinally striate, deplanate, with a vestigial median tubercle, but with lateral tubercles well developed, and posterodorsally with a very weak median longitudinal furrow. Fore wing length 19–23 mm. Hind femur slender, cylindrical. Gaster quite slender, tergite 2 about 2.3 times as long as posteriorly deep; male with gonosquama apically elongately tapered, slightly upcurved.

REMARKS. I have compared this species with all available types of Mesoamerican species and I believe it is undescribed. However, species in this group exhibit a wide range of variation, and I believe it is best to refrain from describing this species until such time as a revision of all the Mesoamerican species of the *atriventris* species-group is undertaken. Species 1 may be separated from other taxa in this species-group by the combination of the entirely black wings, the strongly impressed notauli, the well-developed lateral propodeal crests and its slender hind femora. It has a more slender gaster and is rather more polished than either *T. rivinae* or *T. maculipennis*.

BIOLOGICAL INFORMATION. *Thyreodon* species 1 is only known to occur in Costa Rica in moist forests at altitudes between 600 and 800 m. It is thus allopatric with the rather similar species, *T. rivinae* and *T. maculipennis*. All examined specimens of species 1 were collected at light. Its host is unknown.

MATERIAL EXAMINED

Costa Rica: Alajuela Prov.: 1 ♂, 2 ♀, San Ramón Forest Reserve, Río San Lorencito, 800 m, xi-xii.1986 (*Chacon*) (BMNH); 1 ♂, Finca Campana, 5 km NW. Dos Ríos, 750 m, iii.1985 (*Janzen & Hallwachs*) (BMNH); 1 ♀, Finca San Gabriel, 16 km ENE. Quebrada Grande, 680 m, iii.1983 (*Janzen & Hallwachs*) (BMNH).

Thyreodon santarosae Porter

Thyreodon santarosae Porter, 1986: 133. Holotype ♂, COSTA RICA (USNM).

DIAGNOSIS. A generally black or brownish black species, with antenna from blackish to yellowish; gastral tergites 2 to 3 and legs usually paler brownish-marked; wings from hyaline with bases and apices infumate, to extensively infumate basally and apically with only a central hyaline area. Ocelli small, the hind ones separated from the eyes by more than their maximum diameter; genae rounded or slightly expanded behind eyes; occipital carina ventrally incomplete, turned towards hypostomal carina. Mesoscutum with notauli broad and shallow, barely convergent posteriorly, impressed about 0.8 of mesoscutum and without an anterior crest; mesopleuron centrally quite closely punctate; propodeum extensively smooth and polished, with indistinct median and lateral tubercles. Fore wing length 15–19 mm. Hind femur moderately stout. Gaster stout, tergite 2 less than twice as long as posteriorly deep; male with gonosquama apically acute, slightly up-curved.

REMARKS. *Thyreodon santarosae* is most easily distinguished from other species by the smooth and polished posterior face of the propodeum. Porter (1986) gives a detailed description of this species and describes its variation.

BIOLOGICAL INFORMATION. *Thyreodon santarosae* is the only species of the *atricolor* subgroup that is known to occur in Costa Rica, and has only been collected in Santa Rosa National Park, in the seasonally dry north-eastern part of Guanacaste Province. This species has never been collected in Malaise traps or at light. All known specimens have been reared from hosts collected 3–20 m above the ground, so it is likely that this species only flies high in the canopy. Specimens have been reared by D. H. Janzen from the larvae of the ceratocampine saturniids *Syssphinx molina* (Cramer), *Ptiloscola dargei* Lemaire and *Othorene purpurascens* (Schaus) which feed in the crowns of trees of the families Leguminosae and Sapotaceae (Janzen, 1982; 1984*a*). The parasitoid adults emerged between late April and December, so the species is probably on the wing throughout the wet season.

MATERIAL EXAMINED

Costa Rica: Guanacaste Prov.: 1 ♂, 1 ♀, Santa Rosa National Park, 300 m, 1984 (*Janzen*) (BMNH).

Thyreodon apricus Porter

(Figs 67, 69)

Thyreodon apricus Porter, 1984: 57. Holotype ♂, MEXICO (FSCA).

DIAGNOSIS. A jet-black species with distal 0.8 of flagellum blackish brown; wings entirely blackish. Ocelli small, the hind ones separated from the eyes by more than the maximum ocellar diameter; genae weakly narrowed behind eyes, those of male slightly inflated; occipital carina ventrally incomplete, its end slightly turned towards hypostomal carina. Mesoscutum with notauli very strongly impressed, rugose, anteriorly with a distinct transverse crest (Fig. 69); mesopleuron centrally smooth, with isolated fine punctures; propodeum finely rugose reticulate posteriorly, without distinct median and lateral tubercles, posterodorsally with a deep median longitudinal furrow that is bordered posteriorly by broad shallow secondary furrows (Fig. 67). Fore wing length 16–19 mm. Hind femur moderately stout, distally slightly compressed. Male with segments 1–4 of hind tarsus ventrally bearing a row of long stout erect hairs. Gaster quite slender, tergite 2 2.2–2.7 times as long as posteriorly deep; male with gonosquama apico-dorsal angle produced into a moderately long acute process.

REMARKS. *Thyreodon apricus* is most easily recognized by the presence of the secondary dorsolateral furrows on the posterior face of the propodeum, and by the possession of strong, transverse crests anteriorly across the notauli. Porter (1984) remarked that this species appears to be closely related to *T. ferrugineus* Hooker, a Mexican species.

BIOLOGICAL INFORMATION. *Thyreodon apricus* is a fairly widely distributed species whose range extends from Hidalgo County in the extreme south of Texas, U.S.A., south through Mexico and Guatemala to northern Costa Rica. Porter (1984) remarked that this species occurs in hot, low-altitude, semiarid habitats in the United States and Mexico. In Costa Rica this species is only known to occur in Santa Rosa National Park, where it has only been collected in very open regenerating woodland in early June. It has never been collected at light and its hosts in Santa Rosa are unknown.

MATERIAL EXAMINED

Costa Rica: 1 ♂, 1 ♀, Guanacaste Prov., Santa Rosa National Park, 300 m, in Malaise trap in open woodland west of administration area, vi.1985 (*Janzen & Gauld*) (BMNH).

Thyreodon erythrocera Cameron

(Fig. 58)

Thyreodon erythrocera Cameron, 1886: 288. Holotype ♀, MEXICO (BMNH) [examined].
Thyreodon erythrocerus Cameron; Dalla Torre, 1901: 185. [Unjustified emendation.]

DIAGNOSIS. A shining black species with legs brownish black; antenna of Costa Rican specimen dark brown, of other material orange-yellow; wings black with metallic purplish reflections. Ocelli small, the hind ones separated from the eyes by more than their own diameter; genae evenly constricted behind eyes; occipital carina ventrally complete, evenly convergent with and joining hypostomal carina far above base of mandible. Mesoscutum with notauli weakly impressed, broad (especially towards the anterior end) and reticulate with a low rugose crest anteriorly; mesopleuron smooth, with very sparse, minute punctures; propodeum extensively coriaceous posteriorly, without median and lateral tubercles, posterodorsally with a shallow narrow median longitudinal furrow. Fore wing length 18–23 mm. Hind femur stout, distally strongly laterally compressed. Gaster quite stout, tergite 2 less than twice as long as posteriorly deep; male with gonosquama apically obliquely truncate, upper angle acute.

VARIATION. Porter (1984) characterizes this species by the ventrally complete occipital carina, a feature also possessed by the Costa Rican specimen, but the occipital carina of the holotype does not reach the hypostomal carina. The possibility thus exists that *erythrocera* (as represented by the holotype) is a different species, but more extensive material will need to be collected and examined before this matter can be resolved. The Costa Rican specimen differs from other individuals in having dark brown rather than orange-yellow antennae, and in having rather finer propodeal sculpture.

REMARKS. Although I am not absolutely certain that the Costa Rican specimens are conspecific with either the holotype or the material determined by Porter as *T. erythrocera*, they are very similar and best treated under this species name until such time as more material is collected for study. The ventrally complete occipital carina distinguishes this species from all other *Thyreodon* species in Costa Rica.

BIOLOGICAL INFORMATION. Two individuals of this species have been collected in Santa Rosa National Park during the first half of the wet season. It is otherwise only known from southern Arizona, in the south-western United States, and Mexico, where it apparently flies in deserts and thorn scrubs after late season rains (Porter, 1984).

MATERIAL EXAMINED

Holotype ♀, **Mexico**: Yucatan, Valladolid (BMNH).

Costa Rica: Guanacaste Prov.: 2 ♀, Santa Rosa National Park, 300 m, vi-vii.1984 (*Janzen & Hallwachs*) (BMNH). **Mexico**: Nuevo León: 1 ♀, Pedro Iturbide, 32 km W. Linares, x.1962 (*Townes*) (TC): Sonora: 1 ♂, 1 ♀, Cananca, viii.1974 (*Erickson*) (TC); 1 ♀, 'N. Sonora' (*Morrison*) (BMNH).

Thyreodon laticinctus Cresson

(Figs 62, 68, 70)

Thyreodon laticinctus Cresson, 1874: 376. Holotype ♀, MEXICO (PANS) [examined].
Thyreodon principalis Smith, 1879: 230. Holotype ♀, COSTA RICA (BMNH) [examined]. [Synonymized by Morley, 1912: 9.]

Thyreodon zonatus Szépligeti, 1906: 134. Lectotype ♂, BOLIVIA (TM), designated by Townes & Townes (1966: 189). [Synonymized by Townes & Townes, 1966: 189.]
Oleter selenaction Shestakov, 1926: 259. Lectotype ♀, 'NOVA GRENADA' (ZIL), designated by Townes & Townes (1966: 189). [Synonymized by Cushman, 1947: 427.]

DIAGNOSIS. A jet-black species with segments 3 and 4 of gaster predominantly bright yellow; wings uniformly blackish. Ocelli very small, the hind ones separated from the eyes by far more than the maximum ocellar diameter; genae evenly constricted behind eyes; occipital carina ventrally incomplete, its end turned towards hypostomal carina. Mesoscutum with notauli very broad and weakly impressed, rugose, with a weakly developed crest margining the mesal side anteriorly (Fig. 70); mesopleuron centrally with close, shallow punctures; propodeum extensively diagonally striate posteriorly, without a median tubercle, but with weak elongate lateral tubercles, posterodorsally with broad, quite deep median longitudinal furrrow (Fig. 68). Fore wing length 18–22 mm. Hind femur slender, cylindrical. Gaster quite slender, tergite 2 more than twice as long as posteriorly deep; male with gonosquama with upper corner apically produced into an elongate spine-like process.

REMARKS. *Thyreodon laticinctus* is instantly recognizable on account of its colour pattern. It is the only Mesoamerican species that is black with a centrally bright yellow gaster.

BIOLOGICAL INFORMATION. *Thyreodon laticinctus* is a widespread species in tropical Central America, and its range extends southwards into South America. Porter (1984: 63) described *T. laticinctus* as 'the most hygrophilous and precinctively sylvan Middle American *Thyreodon*'. In Costa Rica *T. laticinctus* occurs in wet forests from sea level up to an altitude of about 2200 m and, at Monteverde (1300 m) W. Haber reared one specimen from the larva of *Xylophanes anubus* (Cramer). *T. laticinctus* has never been collected in seasonally dry Pacific forests, despite the fact that its known host occurs commonly in this locality, feeding as larvae on rubiaceous shrubs (Janzen, 1984*a*)

MATERIAL EXAMINED

Holotype ♀ (*Thyreodon laticinctus* Cresson), **Mexico**: Orizaba (PANS). Holotype ♀ (*Thyreodon principalis* Smith), **Costa Rica**: Cachi (BMNH).

Belize: 1 ♂, Punta Gorda (BMNH). **Costa Rica**: Cartago Prov.: 1 ♂, Turrialba (USNM); 1 ♀, Volcán Irazú, 2–2200 m (*Rodgers*) (BMNH): Guanacaste Prov.: 1 ♀, Volcán Orosi, Casa Maritza [= Mariksa], 700 m, vi.1986 (*Gauld*) (BMNH): Limón Prov.: 1 ♀, Guapiles (*Schaus*) (USNM): San José Prov.: 1 ♀, Braulio Carrillo National Park, 500 m, iv.1985 (*Goulet & Masner*) (CNC). **Guatemala**: 1 ♂, Senahu, Vera Paz (*Champion*) (BMNH); 1 ♀, Zapote (*Champion*) (BMNH). **Mexico**: Orizaba: 1 ♂, Omealca (*Trujillo*) (BMNH). **Nicaragua**: 1 ♀, Chontales (BMNH). **Panama**: 1 ♂, Cerro Campana, vii.1970 (*Howden*) (TC). I have also examined specimens from **Colombia, Ecuador and Peru.**

***Thyreodon morosus* Smith**

(Fig. 59)

Thyreodon morosus Smith, 1879: 230. Holotype ♀, COSTA RICA (BMNH) [examined].
Thyreodon pulchricornis Szépligeti, 1906: 133. Lectotype ♀, PERU (TM), designated by Townes & Townes (1966: 190). [Synonymized by Hooker, 1912: 112.]

DIAGNOSIS. A jet-black species with proximal 0.6 or more of flagellum whitish or whitish yellow; wings entirely blackish. Ocelli small, the hind ones separated from the eyes by more than the maximum ocellar diameter; genae weakly constricted behind eyes; occipital carina ventrally incomplete, its end slightly turned towards hypostomal carina. Mesoscutum with notauli weakly impressed, quite broad and rugose, anteriorly without a distinct crest; mesopleuron centrally with close fine punctures; propodeum extensively diagonally striate posteriorly, without distinct median and lateral tubercles, posterodorsally with a shallow median longitudinal furrow. Fore wing length 18–23 mm. Hind femur moderately slender, distally cylindrical. Gaster quite slender, tergite 2 more than 2.5 times as long as posteriorly deep; male with gonosquama apically indented, with dorsal and ventral short acute processes.

REMARKS. *Thyreodon morosus* is immediately recognizable on account of the colour of its antennae. In freshly collected specimens the basal two-thirds of the flagellum is white, though this seems to become yellowish white with age after death.

BIOLOGICAL INFORMATION. A widely distributed tropical species whose range extends from southern Mexico to Peru. In Costa Rica *T. morosus* has only been collected in or adjacent to humid forests. Its hosts are unknown.

Material Examined

Holotype ♀, **Costa Rica**: Cachí (BMNH).

Costa Rica: Alajuela Prov.: 1 ♂, 1.6 km S. La Marina, 600 m, x.1966 (*Paulson*) (FSCA): Guanacaste Prov.: 1 ♀, Estacion Mengo, SW. side Volcán Cacao, 1000 m, vi.1987 (*Janzen*) (BMNH): San José Prov.: 1 ♀, Braulio Carrillo National Park, 500 m, iv.1985 (*Goulet & Masner*) (CNC). **Mexico**: Yucatan: 1 ♂, Valladolid (BMNH). **Panama**: 1 ♀, Anajuelo, iv.1911 (*Buschk*) (USNM).

The *ENICOSPILUS* genus-group

PRETHOPHION Townes

Prethophion Townes, 1971: 74. Type-species: *Prethophion latus* Townes, by original designation.

Diagnosis. Stout, orange-brown insects with weakly yellowed wings; fore wing length 17–20 mm. Mandibles weakly twisted but strongly narrowed; maxillae and labium unspecialized; clypeus apically convex; occipital carina absent. Notauli vestigial; mesopleural furrow extending from episternal scrobe to subalar prominence; unusual in that epicnemial carina absent laterally from the mesopleuron; posterior transverse carina of the mesosternum represented by vestiges laterally. Fore wing (Fig. 8) with *Rs+2r* almost straight; discosubmarginal cell without a hairless area in the anterior corner; pterostigma moderately broad; 1*m-cu* sinuous; hind wing with *Rs* almost straight; distal abscissa of *Cu*1 basally almost equidistant between *M* and 1*A*. Fore tibial spur without a membrane behind comb. Gaster stout; second segment with epipleuron usually folded under (rarely becoming pendant in some dried individuals); tergite 2 of similar length to tergite 3; ovipositor proximally extremely stout.

Remarks. *Prethophion* contains a single described species, *P. latus*, which is widely distributed throughout tropical South America from Bolivia north to central Costa Rica

Prethophion latus Townes

(Fig. 8)

Prethophion latus Townes, 1971: 75. Holotype ♀, BOLIVIA (TC) [examined].

Description. Mandibles small, malar space less than 0.2 times basal mandibular width; ocelli large, the posterior ones contiguous with the eye margin; occiput abruptly declivous behind posterior ocelli. Flagellum with 48–51 segments, the 20th segment 1.8–2.0 times as long as broad.

Mesoscutum weakly polished, finely punctate; mesopleuron finely punctate, the area between the punctures microreticulate; scutellum without lateral carinae; lateral part of metanotum strongly inflated; metapleuron convex, sculptured like mesopleuron. Propodeum in profile short, abruptly declivous; anterior transverse carina complete centrally, lateral extremities absent; posterior transverse carina represented laterally by strong raised crests; lateral longitudinal carina complete, joined to spiracular margin by a raised ridge.

Gaster stout; male with sternites unspecialized; female with ovipositor strongly laterally compressed.

Orange-brown species with head paler yellowish; median mesoscutal vitta infuscate; antenna black; interocellar area slightly infuscate between posterior ocelli; pterostigma brownish, wings slightly yellowish.

Variation. The Central and South American specimens are extremely similar in structure, sculpture and coloration.

Remarks. This large, robust species is superficially similar to some of the stouter species in the *Enicospilus americanus* species-complex. It differs most obviously from these taxa in lacking any trace of the occipital carina.

Biological Information. In Central America *Prethophion latus* has occasionally been collected at light in lower montane wet forests at altitudes between 700 and 1100 m. Nothing is known of the host preferences of this insect.

Material Examined.

Holotype ♀, **Bolivia**: Cochabamba, Alto Palmar, 1100 m, ix.1960 (*Walz*) (TC). Paratype. **Peru**: 1 ♀, Cuzco, Paucartambo, 400 m, ii.1952 (*Woytkowski*) (TC).

Costa Rica: San José Prov.: 1 ♂, 1 ♀, Braulio Carrillo National Park, Estacion Carrillo, 700 m, ii-iii.1985 (*Chacon*) (BMNH). **Panama**: Chiriqui Prov.: 2 ♀, Fortuna, 1050 m, ii, v.1978 (*Wolda*) (RNH).

SIMOPHION Cushman

Simophion Cushman, 1947: 446. Type-species: *Simophion excarinatus* Cushman, by original designation.

DIAGNOSIS. Slender, orange-brown insects with hyaline wings; fore wing length 13–16 mm. Mandibles not distinctly twisted, weakly narrowed; maxillae and labium unspecialized; clypeus apically slightly concave; occipital carina complete. Notauli vestigial; mesopleural furrow extending from episternal scrobe to subalar prominence; unusual in that epicnemial carina absent laterally from the mesopleuron; posterior transverse carina of the mesosternum represented by vestiges laterally. Fore wing with *Rs+2r* slightly bowed; discosubmarginal cell with a hairless area in the anterior corner; pterostigma moderately broad; *1m-cu* strongly bowed; hind wing with *Rs* bowed; distal abscissa of *Cu*1 basally closer to *1A* than to *M*. Fore tibial spur without a membrane behind comb. Gaster slender; second segment with epipleuron pendant (in Mesoamerican species); tergite 2 of similar length to tergite 3.

REMARKS. *Simophion* is a small genus with a few species in arid areas of the south-western United States, the Middle East and Central Asia (Townes, 1971; Gauld, 1985). The damaged holotype and only known specimen of *Ophion melanostigma* Cameron seems to belong to *Simophion* as it possesses the apomorphic features that characterize the genus; it has no flange on the fore tibial spur, has no propodeal carinae, lacks the posterior transverse carina of the mesosternum and has no epicnemial carina. However, it also possesses a number of apomorphic features that have not been found to occur in other *Simophion* species, namely a blunt trochantellar tooth, a subcentral petiolar spiracle, a pendant laterotergite 2 and a strongly bowed *1m-cu*. As *O. melanostigma* and *Simophion* are only united by 'loss' apomorphies, its placement in this genus must be considered tentative. The holotype of *S. melanostigma* is damaged and lacks the posterior part of the gaster so I cannot be certain which sex it is. It is reputed to be a male (Townes & Townes, 1966), but the claws are more like those of a female. If it is a male then the form of the claw clearly separates it from *Ophiogastrella*, but if it is a female there is a possibility that it could be an extremely aberrant species of *Ophiogastrella*. Its systematic position will be more clearly resolvable if a male were known.

Simophion melanostigma (Cameron) **comb. n.**

Ophion melanostigma Cameron, 1886: 295. Holotype ? ♀, PANAMA (BMNH) [examined].

DESCRIPTION. Mandibles moderately long, the upper tooth slightly longer and distinctly broader than the lower tooth; outer surface of mandible coarsely and shallowly punctate, with microreticulation between punctures, flat with a strong proximal concavity; malar space about 0.1 times as long as the basal mandibular width. Head in front view with width across the eyes 1.5 times the maximum height from the vertex to the clypeal apex; clypeus weakly convex, polished punctate; lower face unusually flat, rather closely punctate centrally; eyes ventrally slightly divergent. Posterior ocelli very close to eye margins; head posteriorly slightly buccate; occipital carina mediodorsally complete, slightly pointed, ventrally very strong, joining hypostomal carina. Antenna long and slender with 61 flagellar segments; 20th segment 2.5 times as long as broad.

Mesoscutum highly polished, in profile evenly rounded; notauli very weak. Mesopleuron polished, finely and sparsely punctate. Scutellum flat, long, quite narrow but not strongly tapered posteriorly, carinate only at extreme anterior end. Metapleuron weakly convex, polished, obsoletely punctate. Propodeum smooth and polished, evenly declivous, dorsally rather flattened; propodeal carinae absent.

Fore wing length about 16 mm; CI = 0.53; ICI = 0.67; SDI = 1.10; *Rs+2r* barely thickened or turned basally, centrally rather evenly bowed; *1m-cu* evenly bowed, without a ramellus; discosubmarginal cell with a large glabrous area anteriorly; 1st subdiscal cell evenly sparsely hirsute; *cu-a* opposite base of *Rs&M*. Hind wing with *Rs* curved through about 45°; marginal cell proximally with a glabrous area.

Legs slender, unspecialized except that the posterior two pairs have the distal margin of the trochantelli ventrally produced into a blunt tooth; mid tibial spurs unusual in being almost equal in length, the longer 1.05 times the length of the shorter; hind coxa slender, in profile about 2.4 times as long as deep; hind trochantellus mediodorsally about 0.8 times as long as broad.

Gaster quite slender; tergite 1 unusual in that the spiracle is positioned quite far forwards, about 0.6 of the way along the segment; segment 2 with laterotergite pendant; umbo indistinct.

Golden yellowish species with antennae reddish brown, interocellar area slightly infuscate; wings hyaline, pterostigma dark brown.

REMARKS. *Simophion melanostigma* differs from all other species in the genus in having a pendant laterotergite, a very slender *Rs+2r* in the fore wing, more or less equal mid tibial spurs and no distinct umbo. Furthermore it is the only species of *Simophion* that occurs outside of arid habitats, and I have some doubt that it is correctly placed here.

Biological Information. This species has only been taken at an altitude of between 650–1000 m on Volcán de Chiriqui in Panama. I have not seen this habitat, but presumably it would be an area of very wet forest. Although I have seen no other examples from Central America, there is no reason to doubt the locality data given on this specimen.

Material Examined

Holotype ? ♀, **Panama**: Volcán de Chiriqui, 650–1000 m (BMNH).

OPHIOGASTRELLA Brues

Ophiogastrella Brues, 1912: 201. Type-species: *Ophiogastrella maculithorax* Brues, by original designation.

Brachyscenia Enderlein, 1921: 36. Type-species: *Brachyscenia nigriventris* Enderlein, by original designation.

Diagnosis. Slender orange or yellowish, sometimes black-marked species; fore wing length 6–16 mm. Mandibles not twisted; maxillae and labium unspecialized; clypeus truncate or slightly concave; occipital carina complete. Notauli vestigial or absent; mesopleural furrow vestigial; posterior transverse carina of mesosternum represented by lateral vestiges. Fore wing generally with *Rs+2r* slender and not strongly curved, rarely basally incrassate and angulate; discosubmarginal cell with a hairless area in anterior corner; pterostigma moderately stout; 1*mcu* generally evenly curved; hind wing with *Rs* straight to bowed; distal abscissa of *Cu*1 basally from almost equidistant between *M* and 1*A*, to closer to 1*A* than to *M*. Fore tibial spur without a membrane behind comb. Gaster slender; second segment with laterotergite folded under, or narrow, membranous and pendant; tergite 2 longer than tergite 3; male unusual in having the pectinal teeth extending around apex of flattened claws (Fig. 15).

Remarks. *Ophiogastrella* is a small genus that is endemic to tropical America and whose cumulative range extends from tropical Central America to southern Brazil. Three species have been described from South America, and probably about eight more are undescribed in the whole Neotropical realm.

In Central America several species of *Ophiogastrella* can be quite common in seasonally dry areas. In Pacific dry forest in Santa Rosa National Park, Costa Rica, four synchronous, sympatric species occur in fairly large numbers at the start of the wet season. All have a very short flight period of only a few weeks. Nothing is known of the host preferences of any of them. These species are keyed and described below.

Key to Mesoamerican species of *Ophiogastrella*

1 Marginal cell of hind wing uniformly (but sometimes sparsely) hirsute proximally (Fig. 72); fore wing with *Rs+2r* basally quite strongly thickened and somewhat angulate (Fig. 75); occipital carina arched upwards into a point mediodorsally, male with distal margin of subgenital plate bearing a distinct median acute tooth (Fig. 80)...................... ***gonzalezi*** sp. n. (p. 68)

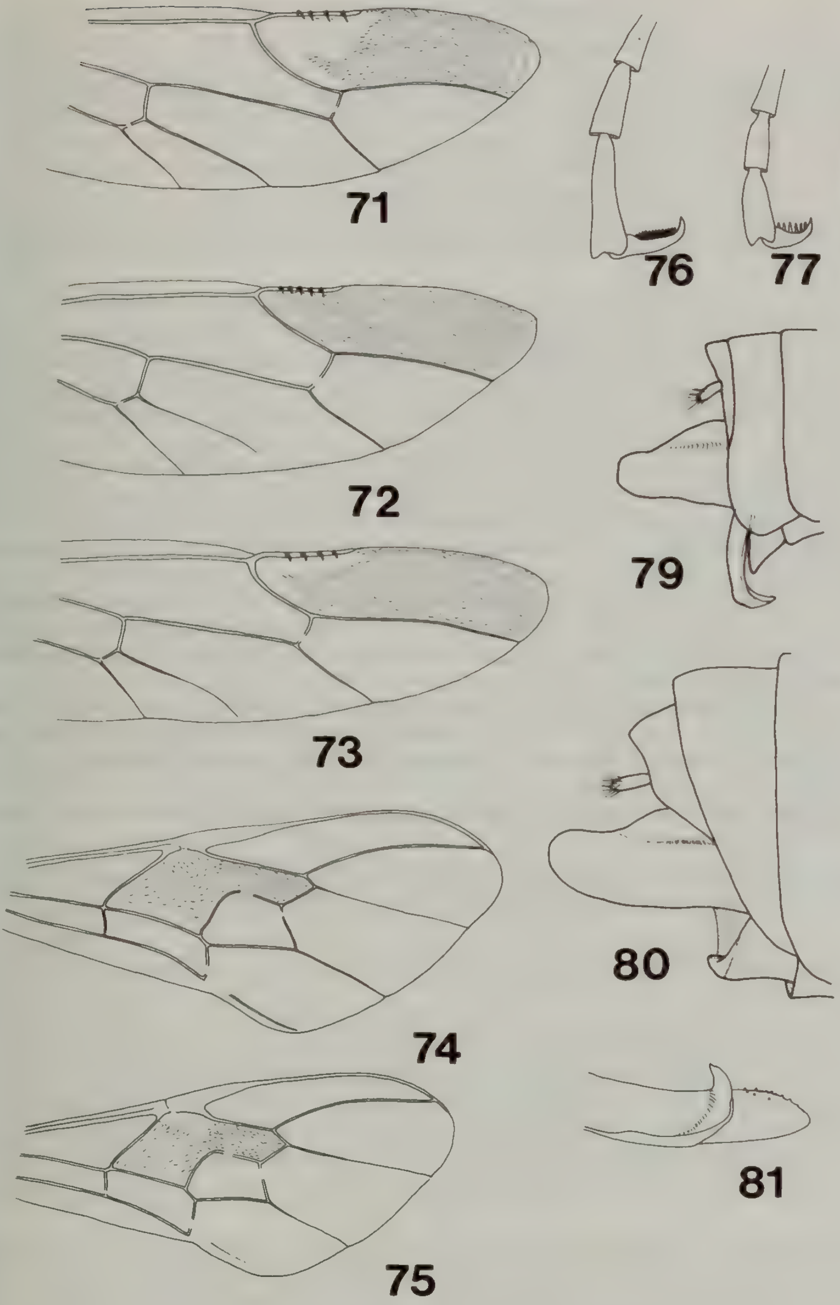
– Marginal cell of hind wing with a large glabrous area proximally (Figs 71,73); fore wing with *Rs+2r* basally only slightly thickened, almost straight to weakly bowed (Fig. 74); occipital carina mediodorsally evenly convex or slightly flattened; male without a median acute tooth on distal margin of subgenital plate (Fig. 79) 2

2 Propodeum smooth, with anterior transverse carina absent or very indistinct; female with distal tarsal segment bearing a lateral protuberance distal to which is a distinct notch (Fig. 78); male with apex of aedeagus curved upwards and acute (Fig. 79); small species, fore wing length 6–9 mm.. ***maculithorax*** Brues (p. 69)

– Propodeum with anterior transverse carina broadly present centrally; female with distal tarsal segment without a lateral protuberance or notch (Figs 76, 77); male with apex of aedeagus rounded; large species, fore wing length 13–14 mm 3

3 Hind wing with *Rs* very strongly bowed, marginal cell broad (Fig. 71); interocellar area yellowish brown; fore tarsal claws of female long and slender (Fig. 76)........... ***lemairei*** sp. n. (p. 70)

– Hind wing with *Rs* weakly bowed, marginal cell not unusually broad (Fig. 73); interocellar area black; fore tarsal claws of female unremarkable, evenly curved and quite short (Fig. 77) ***stilesi*** sp. n. (p. 71)



Figs 71–81 *Ophiogastrella* species. 71–73, hind wing showing arrangement of hair in marginal cell; (71) *O. lemairei*; (72) *O. gonzalezi*; (73) *O. stilesi*. 74–75, fore wing; (74) *O. lemairei*; (75) *O. gonzalezi*. 76–78, distal segments of fore tarsus of female; (76) *O. lemairei*; (77) *O. stilesi*; (78) *O. maculithorax*. 79, 80, terminal segments of gaster of male; (79) *O. maculithorax*; (80) *O. gonzalezi*. 81, aedeagus, *O. gonzalezi*.

Ophiogastrella gonzalezi sp. n.

(Figs 15, 72, 75, 80, 81)

Description. Mandibles rather short and stout, apically evenly but weakly narrowed, with upper tooth 1.1–1.3 times as long as the lower; outer mandibular surface flat, with fine sparse punctures; malar space 0.3 times as long as basal mandibular width. Clypeus in profile almost flat, margin blunt to subacute; clypeus in front view 1.8–2.1 times as broad as long, the margin apically truncate or subacute. Lower face 0.90–0.93 times as broad as long, finely and sparsely punctate. Head in dorsal view with genae slightly inflated behind eyes; occipital carina mediodorsally arched upwards to form a blunt point, ventrally strong, joining hypostomal carina. Antenna moderately long and slender, with 48–50 flagellar segments; 20th segment 1.8–2.0 times as long as broad.

Mesoscutum punctate, in profile abruptly rounded with anterior margin turned forwards. Mesopleuron highly polished, the upper part very finely punctate, the lower part coarsely but sparsely punctate; epicnemial carina weak but almost complete. Metapleuron fairly weakly convex, closely and quite coarsely punctate. Propodeum in profile abruptly declivous; anterior transverse carina broadly complete centrally, the lateral extremities absent; posterior area coriaceous; lateral longitudinal carina discernible as an impression.

Fore wing length 11–13 mm; AI = 1.75–1.90; CI = 0.40–0.46; ICI = 0.46–0.57; SDI = 0.92–0.96; *Rs+2r* basally strongly swollen, angulate; *cu-a* opposite or proximal to base of *Rs&M* by about 0.1 times its own length; discosubmarginal cell anteriorly with a large glabrous area. Hind wing with 5–6 hamuli on *R*1; 1st abscissa of *Rs* straight or weakly bowed, marginal cell quite broad, distally uniformly hirsute; 2nd abscissa of *Rs* more or less straight.

Fore leg of female with anterior edge of distal segment of tarsus bearing an acute protuberance below which is a distinct notch; mid leg with longer tibial spur 1.2–1.4 times length of the shorter. Hind leg with trochantellus dorsally 0.2–0.3 times as long as broad, its distal margin laterally slightly angularly produced; tarsal claws of female quite short and abruptly curved.

Gaster slender; tergite 2 in profile 4 or more times as long as posteriorly deep, laterotergite more or less folded under. Female with ovipositor slender, slightly depressed; male with subgenital plate with a median distal tooth-like projection; aedeagus with strongly raised lateral keels, and apex rounded, bearing small sharp tubercles (Fig. 81).

Colour generally golden brown, head more yellowish; interocellar area black; antenna distally infuscate; pterostigma brownish; wings hyaline.

Variation. There is some variation in coloration. Although the majority of individuals are golden brown about 15 % of the specimens have the alitrunk extensively bright yellow-marked on the scutellum and the mesopleuron.

Remarks. This species is named in honour of León Gonzalez for his enthusiastic work in land acquisition for Guanacaste National Park.

Ophiogastrella gonzalezi resembles *O. maculithorax* in that the female has a specialized distal fore tarsal segment. The male does not have this tarsal segment so modified, but may be distinguished from all other species by the presence of a median acute tooth on the margin of the subgenital plate, and by the form of the aedeagus (Fig. 81). The form and pilosity of the marginal cell of the hind wing of this species, and the rather angulate incrassate base of *Rs+2r* in the fore wing are quite unlike those of any other Mesoamerican species but strongly resemble two from South America, *O. nigrifrons* (Enderlein) and *O. nigriventris* (Enderlein). Neither of these species occur in Central America, and the males of both have simple subgenital plates.

Biological Information. *O. gonzalezi* is the most frequently collected of the four Mesoamerican species of *Ophiogastrella*. I have often taken it at a light overlooking the canopy of a seasonally dry forest in Santa Rosa National Park at the beginning of the rainy season. It apparently has a rather short flight period and the cumulative seasonal distribution data from Santa Rosa for 1983–6 are:

J	F	M	A	M	J	J	A	S	O	N	D
–	–	–	2	28	38	10	–	–	–	–	–

O. gonzalezi has also been collected at light in a mature dry forest on the slopes of Cerro El Hacha, and in scrub adjacent to Casa Maritza. The host of this species is not known.

Material Examined

Holotype ♂, **Costa Rica**: Guanacaste Province, Santa Rosa National Park, 300 m, v.1986 (*Gauld*) (BMNH).

Paratypes. **Costa Rica**: 34 ♂, 41 ♀, same locality as holotype, iv-vii.1983–6 (*Janzen, Hallwachs & Gauld*) (BMNH, CNC, MNCR, TC, USNM); 1 ♂, 1 ♀, Santa Rosa National Park, SE. of Entrada, vi.1986 (*Godfrey*) (BMNH); 1 ♂, 2 ♀, Cerro El Hacha, 310 m, v.1986 (*Janzen & Gauld*) (BMNH); 1 ♀, Casa Maritza, on lower slope of Volcán Orosi, 700 m, vi.1986 (*Gauld*) (BMNH).

Ophiogastrella maculithorax Brues

(Figs 78, 79)

Ophiogastrella maculithorax Brues, 1912: 202. LECTOTYPE ♀, BRAZIL (MCZ), here designated [examined].

Description. Mandibles stout, fairly long, apically evenly tapered, with upper tooth 1.0–1.1 times as long as the lower; outer mandibular surface flat, finely punctate; malar space 0.2–0.3 times as long as basal mandibular width. Clypeus in profile moderately convex, margin blunt; clypeus in front view 1.8–1.9 times as broad as long, margin truncate to slightly concave. Lower face 0.86–0.92 times as broad as long, finely punctate. Head in dorsal view with genae slightly inflated behind eyes; occipital carina mediodorsally simply arched, ventrally obsolescent, usually evanescent before reaching hypostomal carina. Antenna long and slender, with 46–52 flagellar segments; 20th segment 1.7-.2.1 times as long as broad.

Mesoscutum smooth and polished, in profile abruptly rounded. Mesopleuron highly polished, the upper part smooth, the lower part sparsely punctate; epicnemial carina curved to meet anterior marin of pleuron. Metapleuron weakly convex, finely punctate. Propodeum in profile abruptly declivous; anterior transverse carina absent, just indicated by a central vestige; posterior area punctate; lateral longitudinal carina represented by a furrow.

Fore wing length 6–9 mm; AI = 2.70–6.30+; CI = 0.24–0.42; ICI = 0.12–0.23; SDI = 0.85–0.89; *Rs+2r* basally slender, almost straight; *cu-a* from subopposite to proximal to base of *Rs&M* by about 0.1 times its own length; discosubmarginal cell anteriorly with a broad glabrous area. Hind wing with 4 hamuli on *R*1; 1st abscissa of *Rs* proximally strongly curved, distally fairly straight; marginal cell broad, proximally broadly glabrous; 2nd abscissa of *Rs* weakly bowed.

Fore leg of female with anterior edge of distal segment of tarsus bearing an acute protuberance below which is a distinct notch; mid leg with longer tibial spur 1.2–1.3 times length of the shorter. Hind leg with trochantellus dorsally 0.3–0.4 times as long as broad, its distal margin laterally bluntly rounded; tarsal claws of female rather short and abruptly curved.

Gaster moderately slender; tergite 2 in profile 3 or more times as long as posteriorly deep, laterotergite folded under. Female with ovipositor quite short; male with subgenital plate thin, apically convex; apex of aedeagus upcurved and acutely pointed.

Colour generally orange insects, head yellowish, mesoscutum usually with 3 longitudinal blackish vittae, and umbo of tergite 2 dark brown; interocellar area black; antenna yellowish, distally infuscate; pterostigma blackish brown; wings hyaline.

Variation. About twenty per cent of the Costa Rican individuals lack the dark marks on the mesoscutum and tergite 2 and have the pterostigma orange. These specimens often also have a slightly less extensive glabrous area in the marginal cell of the hind wing, have a slightly more punctate propodeum and tend to be amongst the largest individuals. However, they otherwise resemble the dark marked individuals closely, especially in lacking a propodeal carina, having a highly modified aedeagus, having a ventrally evanescent occipital carina and having 3*rs-m* very short. I have treated these paler individuals as being conspecific with the darker ones, but they have been listed separately below.

Remarks. Townes & Townes (1966: 171) referred to the lectotype of this species, but I was unable to find a specimen labelled as lectotype in the MCZ. As the syntypes are all from the same locality Townes & Townes' statement that the lectotype is from Guarabira, in Paraiba does not identify which specimen is intended to be the lectotype. I cannot therefore accept their reference to a lectotype as a valid lectotype designation, as it is not unambiguous designation of a particular syntype. Brues (1912) based his description of this species on three females collected at the same locality by Mann and Heath. Dr S. Shaw was only able to locate two of these specimens, one of which had been labelled 'type' by Brues. Accordingly, I hereby designate this specimen as lectotype and have labelled it as such

Ophiogastrella maculithorax, the smallest Central American ophionine species, can immediately be recognized by the smooth polished propodeum and the ventrally evanescent occipital carina. Structurally it is most similar *O. gonzalezi* which it resembles in having a specialized female distal fore tarsal segment.

Biological Information. *Ophiogastrella maculithorax* is a widely ditributed tropical American species whose range extends from Costa Rica south to about 10°S in Brazil. Throughout its range it seems to be associated with habitats that have a pronounced dry season. In Costa Rica *O. maculithorax* is very common species in the drier parts of Santa Rosa National Park, and I have often collected it at a light overlooking the canopy of a deciduous forest at the start of the rainy season. It has been collected in more months of the year than *O. gonzalezi* the other common species of the genus in Santa Rosa, and the seasonal distributional data for *O. maculithorax* for 1983–7 are:

J	F	M	A	M	J	J	A	S	O	N	D
–	–	1	1	17	51	5	–	1	–	–	–

The host of this insect is not known.

MATERIAL EXAMINED

Lectotype ♀, **Brazil**: Parahyba [= Paraiba], Independencia [= Guarabira] (*Mann & Heath*) (MCZ). Paralectotype 1♀, same data as lectotype (MCZ).

Costa Rica: Guanacaste Prov.: 1 ♀, W. of Carmona, Nicoya, 600–700 m, viii.1982 (*Janzen & Hallwachs*) (BMNH); 1 ♀, 2 km E. of Cuajiniquil, vi.1986 (*Gauld*) (BMNH); 26 ♂, 36 ♀, Santa Rosa National Park, 300 m, iii-vii.1983–7 (*Janzen, Hallwachs & Gauld*) (BMNH, CNC, MNCR, TC, USNM); 2 ♀, Santa Rosa National Park, SE. of Entrada, vi.1986 (*Godfrey*) (BMNH).

Other specimens. **Costa Rica**: Guanacaste Province; 3 ♂, 11 ♀, Santa Rosa National Park, 300 m, v-vii, ix.1983–7 (*Janzen & Hallwachs*) (BMNH).

***Ophiogastrella lemairei* sp. n.**

(Figs 71, 74, 76)

DESCRIPTION. Mandibles moderately long, apically quite strongly and evenly tapered, with upper tooth about 1.1 times as long as the lower tooth, but slightly more slender; outer mandibular surface flat, fairly coarsely punctate; malar space 0.3 times as long as basal mandibular width. Clypeus in profile almost flat, margin subacute; clypeus in front view 1.5–1.8 times as broad as long, with apical margin truncate. Lower face 0.77–0.85 times as broad as long, centrally sparsely punctate. Head in dorsal view with genae rounded behind eyes; occipital carina mediodorsally slightly flattened, ventrally complete to hypostomal carina. Antenna long and slender, with 49–52 flagellar segments; 20th segment 1.8–1.9 times as long as broad.

Mesoscutum polished, finely and closely punctate, in profile abruptly rounded with anterior margin outturned. Mesopleuron polished, the upper part sparsely punctate, the lower part with punctures slightly more close together; epicnemial carina weak, but present laterally. Metapleuron moderately convex, finely and sparsely punctate. Propodeum in profile abruptly declivous; anterior transverse carina centrally broadly complete, bowed forwards, with lateral extremities weak; posterior area rugulose; lateral longitudinal carina present anteriorly, posteriorly represented by a furrow.

Fore wing length 13–14 mm; AI = 2.21–3.30; CI = 0.21–0.35; ICI = 0.32–0.37; SDI = 0.85–0.89; *Rs+2r* basally slender, slightly curved; *cu-a* subopposite to base of *Rs&M*; discosubmarginal cell anteriorly with a small glabrous area. Hind wing with 4 slender hamuli on *R*1; 1st abscissa of *Rs* strongly bowed for its entire length, marginal cell very broad, proximally broadly glabrous; 2nd abscissa of *Rs* weakly arcuate.

Fore leg of female with distal segment of tarsus slender, unspecialized; mid leg with longer tibial spur 1.2-1.3 times length of the shorter. Hind leg with trochantellus dorsally 0.4–0.5 times as long as broad, its distal margin laterally bluntly rounded; tarsal claws of female very long and evenly curved apically.

Gaster slender; tergite 2 in profile at least 3.5 times as long as posteriorly deep, laterotergite anteriorly upturned, usually pendant posteriorly. Female with ovipositor slender; male with subgenital plate convexly rounded posteriorly; apex of aedeagus bluntly rounded.

Colour generally uniformly yellowish brown with head and anterior 4 tergites of gaster slightly paler yellowish; terminal segments of gaster slightly infuscate; interocellar area yellowish; antenna yellowish brown; pterostigma orange; wings hyaline.

VARIATION. One male has the gaster uniformly yellowish brown.

REMARKS. This species is names in honour of Claude Lemaire for his tireless efforts to straighten out the taxonomy of saturniid moths.

Ophiogastrella lemairei may easily be recognized by the yellowish interocellar area, the strongly curved *Rs* in the hind wing, the slender hamuli, and the long tarsal claws of the female. Structurally it is most similar to *O. stilesi* in having a slender *Rs+2r* in the fore wing and an unspecialized female distal fore tarsal segment.

Biological Information. *Ophiogastrella lemairei* is only known from Santa Rosa National Park in Costa Rica where it has occasionally been collected at light. The cumulative seasonal distribution data for this species are:

J	F	M	A	M	J	J	A	S	O	N	D
–	1	1	2	4	3	–	–	–	–	–	1

I have collected two individuals at light overlooking a piece of woodland dominated by *Quercus oleoides* (Fagaceae). The host of this insect is not known.

Material Examined

Holotype ♂, **Costa Rica**: Guanacaste Province, Santa Rosa National Park, 300 m, vi.1985 (*Gauld*) (BMNH).

Paratypes. **Costa Rica**: 6 ♂, 5 ♀, same locality as holotype, ii-vi, xii.1983–6 (*Janzen, Hallwachs & Gauld*) (BMNH, CNC, MNCR, TC, USNM).

Ophiogastrella stilesi sp. n.

(Figs 73, 77)

Description. Mandibles moderately long, apically evenly narrowed, with upper tooth 1.0–1.1 times as long as the lower; outer mandibular surface flat, quite coarsely punctate; malar space 0.2 times as long as basal mandibular width. Clypeus in profile weakly convex, margin blunt; clypeus in front view 1.8–1.9 times as broad as long, the margin slightly concave apically. Lower face 0.91–0.96 times as broad as long, centrally finely punctate. Head in dorsal view with genae constricted behind eyes; occipital carina mediodorsally slightly flattened, ventrally complete, joining hypostomal carina. Antenna long and slender, with 56–60 flagellar segments; 20th segment 1.9–2.3 times as long as broad.

Mesoscutum polished with shallow punctures, in profile abruptly rounded with margin slightly outturned. Mesopleuron polished , the upper part with isolated punctures, the lower part slightly more closely punctate; epicnemial carina present laterally. Metapleuron weakly convex, smooth with weak scattered punctures. Propodeum in profile abruptly declivous; anterior transverse carina more or less complete with only lateral extremities evanescent, centrally bowed forwards; posterior area finely and weakly coriaceous; lateral longitudinal carina represented by a groove.

Fore wing length 13–14 mm; AI = 2.10–2.33; CI = 0.32–0.37; ICI = 0.43–0.54; SDI = 0.87–0.92; *Rs+2r* basally slender, almost straight; *cu-a* subopposite to base of *Rs&M*; discosubmarginal cell anteriorly with a small glabrous area. Hind wing with 4 rather stout hamuli on *R*1; 1st abscissa of *Rs* evenly curved, marginal cell quite narrow, proximally glabrous; 2nd abscissa of *Rs* more or less straight.

Fore leg of female with distal segment of tarsus rather short but unspecialized; mid leg with longer tibial spur 1.3–1.4 times length of the shorter. Hind leg with trochantellus dorsally 0.4–0.5 times as long as broad, its distal margin rather angularly rounded and somewhat produced into a blunt tooth; tarsal claws of female short, evenly curved.

Gaster slender; tergite 2 in profile more than 3.5 times as long as posteriorly deep, laterotergite folded under. Female with ovipositor slender apically; male with subgenital plate apically convex; apex of aedeagus rounded.

Colour generally orangey brown, with head paler yellowish and legs golden mesoscutum with brownish longitudinal vittae; interocellar area black; antenna dark brown, with only scape to first flagellar segment orange; pterostigma dark brown; wings very weakly infumate.

Variation. One male is slightly more orange than the other individuals.

Remarks. This species is named for Gary Stiles in honour of his inspiration of hundreds of Costa Rican university students to understand field biology

Structurally *Ophiogastrella stilesi* is rather similar to *O. lemairei*, from which it differs most obviously in the colour of the interocellar area and the form of the marginal cell of the hind wing. *O. stilesi* also has less slender fore tarsal segments, shorter claws and longer antennae than *O. lemairei*.

Biological Information. *Ophiogastrella stilesi* has only been collected in Santa Rosa National Park, where it is fairly uncommonly encountered. Most individuals were collected at the beginning of the rainy season and the cumulative seasonal distribution data for 1982–5 are:

J	F	M	A	M	J	J	A	S	O	N	D
–	–	–	–	2	8	1	–	–	–	1	–

Half of these specimens were collected in one short period during June, 1983 and I have never collected this species despite undertaking a lot of collecting in Santa Rosa during June 1984–6.

Material Examined

Holotype ♂, **Costa Rica**: Guanacaste Province, Santa Rosa National Park, 300 m, vii.1984 (*Janzen & Hallwachs*) (BMNH).

Paratypes. **Costa Rica**: 4 ♂, 7 ♀, same locality as holotype, v-vii, xi.1982–5 (*Janzen & Hallwachs*) (BMNH, CNC, TC, USNM).

STAUROPOCTONUS Brauns

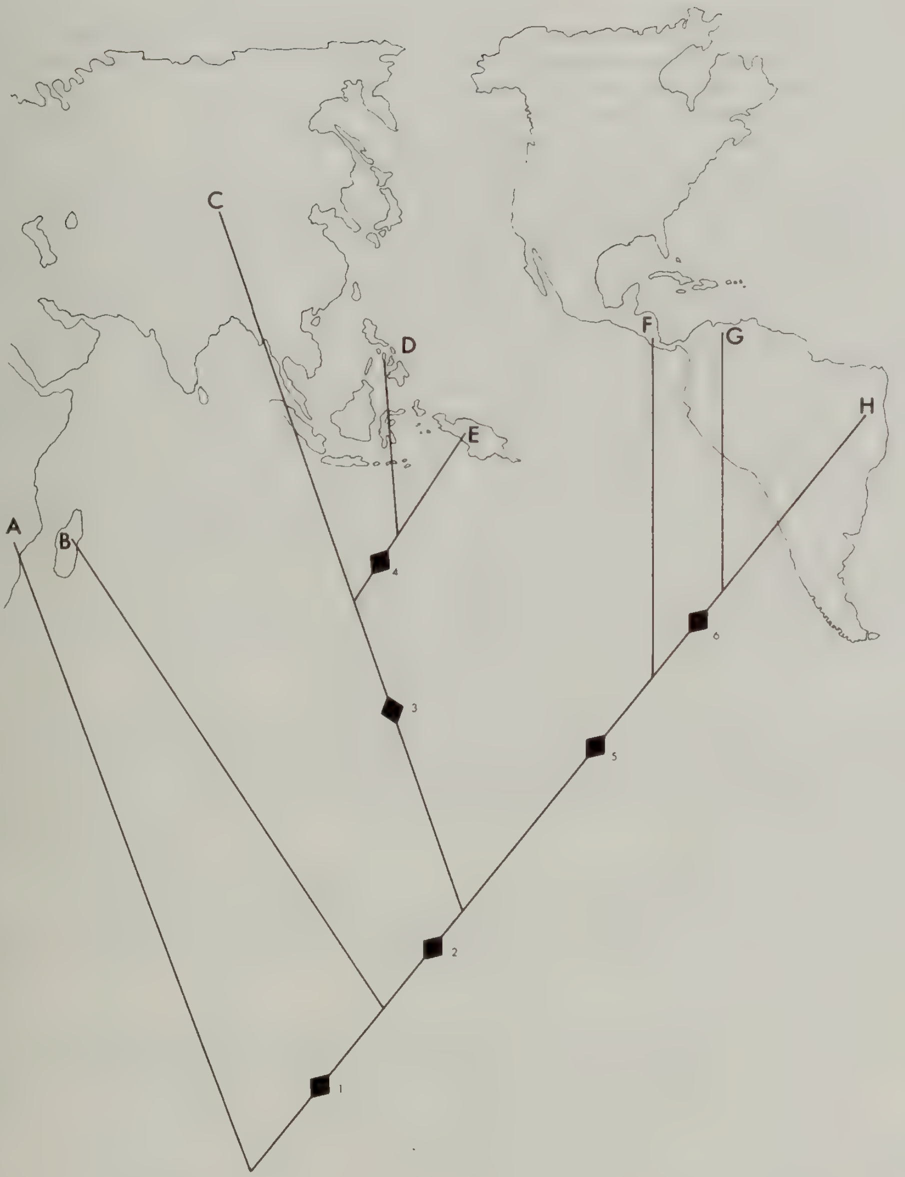
Stauropoctonus Brauns, 1889: 75. Type-species: *Ophion bombycivorus* Gravenhorst, by monotypy.
Stauropodoctonus Morley, 1913: 375. [Unjustified emendation.]
Nipponophion Uchida, 1928: 201. Type-species: *Nipponophion variegatus* Uchida (= *Ophion bombycivorus* Gravenhorst), by monotypy.
Aulophion Cushman, 1947: 458. Type-species: *Aulophion bicarinatus* Cushman, by original designation.

Diagnosis. Orange or yellowish brown insects with hyaline or weakly infumate wings; fore wing length 14–16 mm. Mandibles slender, twisted about 90°; maxillae and labium unspecialized; clypeus truncate or slightly concave; occipital carina absent. Notauli absent; mesopleural furrow transverse, extending from episternal scrobe to upper end of epicnemial carina; posterior transverse carina of mesosternum absent (in Neotropical species). Fore wing with *Rs+2r* basally thickened and abruptly curved; discosubmarginal cell with a glabrous area anteriorly; pterostigma very slender; *1m-cu* bowed; hind wing with *Rs* straight; distal abscissa of *Cu*1 basally closer to 1*A* than to *M*. Fore tibial spur without a membranous flange behind the comb; mid and hind trochantelli unusual in that their distal margins are produced into a sharp, curved tooth. Gaster slender; second segment with epipleuron membranous, pendant (in Neotropical species); tergite 2 longer than tergite 3.

Remarks. *Stauropoctonus* is a small genus with isolated species in the Old World tropics, the Palaearctic and tropical parts of America (Fig. 82). In the New World, *Stauropoctonus* species are primarily associated with wet tropical forests and range from Costa Rica south to southern Brazil. They are rather rarely collected insects and nothing is known of their host preferences.

Both Townes (1971) and Gauld (1985) stated that the Neotropical species lack the lateral part of the epicnemial carina. However, *S. bicarinatus* (Cushman) which occurs in Costa Rica and Panama does have a complete epicnemial carina, though it resembles other Neotropical species (and differs from the Old World species) in lacking a complete posterior transverse carina of the mesosternum and having a pendant laterotergite 2. I have seen representatives of four Neotropical species. Only one, *S. bicarinatus*, is known to occur in Central America whilst the only other described species, *S. excarinatus* (Cushman), occurs nearby in Venezuela; the other species, which are undescribed, occur further south in Brazil and Bolivia.

Fig. 82 The phylogeny and distribution of the *Stauropoctonus* genus-subgroup. The taxa are: A, *Lepiscelus*, a tropical African genus – the sister lineage to *Stauropoctonus*; B, *S. occipitalis*, a Madagascan species; C, *S. bombycivorus*, a widspread Palaearctic species; D, *S. townesorum*, an endemic Philippine species; E, *S. torresi*, a widespread Indonesian species; F, *S. bicarinatus*, a Central American species; G. *S. excarinatus*, a Venezuelan species; H, an undescribed Brazilian species. The holophyly of the genus-subgroup strongly supported (see Gauld, 1985: fig. 19). Clade 1 – the genus *Stauropoctonus* is supported by six apomorphic features: a curved trochanteral tooth; a lenticular head; strongly twisted and tapered mandibles; centrally interrupted occipital carina; possession of a transverse mesopleural furrow; a basally incrassate and curved *Rs+2r* in the fore wing. It is one of the most clearly defined clades in the entire subfamily. The sister-lineage, *Lepiscelus* is also clearly defined by several autapomorphic features. Clade 2 is defined by the complete loss of the occipital carina, having the distal abscissa of *Cu*1 intermediate between *M* and 1*A*, and by having *1m-cu* and *Cu*1a basally only moderately widely separated. Taxon B is also characterized by autapomorphic features, such as the development of scutellar carinae. Clades 3 and 4 are very weak and taxa C, D and E characterized by weak autapomorphies; their arrangement changed in different reconstructions and all are undoubtedly closely interrelated and poorly differentiated from the main evolutionary stem of the group. Clade 5 is quite robust and is supported by four apomorphic features: loss of the posterior mesosternal carina, separation of a pendant second laterotergite, possession of an oblique *cu-a* and movement of distal abscissa of *Cu*1 closer to 1*A*. Clade 6 is also quite robust and supported by three strong apomorphic features: the development of a median longitudinal propodeal carina, an apically incrassate aedeagus and the complete loss of the epicnemial carina.


A
B
C
D
E
F
G
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82

Stauropoctonus bicarinatus (Cushman)

Aulophion bicarinatus Cushman, 1947: 459. Holotype ♀, COSTA RICA (USNM) [examined].
Stauropoctonus bicarinatus (Cushman) Gauld, 1985: 146.

DESCRIPTION. Malar space about 0.3 times as long as basal width of mandible; vertex very narrow; flagellum slender with 55–57 segments.

Pronotum rather swollen so part below the impressed upper margin is subhorizontal. Mesoscutum weakly polished, finely and inconspicuously punctate; mesoscutum with very strongly impressed mesopleural furrow; epicnemial carina laterally complete, reaching to anterior end of mesopleural furrow; scutellum polished, without lateral carinae; metapleuron very weakly convex, finely punctate. Propodeum with anterior transverse carina complete, posterior transverse carina complete or obsolescent medially, and with a vestigial to quite strong median longitudinal ridge.

Fore wing length 14–15 mm; AI = 0.70–0.80; CI =0.25–0.28; ICI = 1.06–1.10; SDI = 0.77–0.79; marginal cell proximally glabrous; discosubmarginal cell anteriorly broadly glabrous, with slight sclerotization near to anterior margin; *cu-a* subopposite to the base of *Rs&M*, oblique. Hind wing with 4 hamuli on *R*1.

Gaster slender; tergite 2 very elongate, with thyridia oval, widely separated from anterior margin of tergite; male sternites unspecialized except that subgenital plate is weakly medially impressed; gonosquama obliquely truncate apically.

Head yellowish; alitrunk and anterior segments of gaster brownish yellow, gastral tergites 3+ infuscate; antenna black; legs golden. Wings weakly infumate; pterostigma blackish brown.

REMARKS. The complete epicnemial carina and swollen propodeum differentiate *S. bicarinatus* from all other Neotropical species.

BIOLOGICAL INFORMATION. This species is only known to occur in lower montane forest in Costa Rica and Panama. Very few specimens have ever been collected, even in sites that have been quite well sampled.

MATERIAL EXAMINED
Holotype ♀, **Costa Rica**: no further data (USNM)
Panama: 1 ♂, Chiriqui Prov., Fortuna, 1050 m, iii.1978 (*Wolda*) (RNH).

ENICOSPILUS Stephens

Enicospilus Stephens, 1835: 126. Type-species: *Ophion merdarius* Gravenhorst sensu Stephens (= *Ichneumon ramidulus* L.), by subsequent monotypy, Stephens, 1845.
Henicospilus Agassiz, 1846: 138. [Unjustified emendation.]
Allocamptus Foerster, 1869: 150. Type-species: *Ophion undulatus* Gravenhorst, by subsequent designation, Thomson, 1888: 1189.
Dispilus Kriechbaumer, 1894: 309. Type-species: *Ophion* (*Dispilus*) *natalensis* Kriechbaumer, by monotypy.
Pleuroneurophion Ashmead, 1900*a*: 86. Type-species: *Pleuroneurophion hawaiiensis* Ashmead, by original designation.
Cymatoneura Kriechbaumer, 1901*a*: 22. Type-species: *Ophion undulatus* Gravenhorst, by subsequent designation, Viereck, 1914: 8.
Pterospilus Kriechbaumer, 1901*d*: 156. Type-species: *Ophion* (*Enicospilus*) *dubius* Tosquinet, by subsequent designation, Viereck, 1914: 126. [Junior homonym of *Pterospilus* Rondani, 1856.]
Trispilus Kriechbaumer, 1901*d*: 156. Type-species: *Ophion* (*Enicospilus*) *trimaculatus* Tosquinet (= *Henicospilus seminiger* Szépligeti), by monotypy.
Metophion Szépligeti, 1905: 28. Type-species: *Metophion bicolor* Szépligeti, by subsequent designation, Viereck, 1914: 94.
Ceratospilus Szépligeti, 1905: 28. Type-species: *Ceratospilus biroi* Szépligeti, by monotypy.
Atoponeura Szépligeti, 1905: 34. Type-species: *Atoponeura concolor* Szépligeti (= *Enicospilus atoponeurus* Cushman), by monotypy.
Ophiomorpha Szépligeti, 1905: 34. Type-species: *Ophion curvinervis* Cameron (= *Enicospilus cameronii* Dalla Torre), by subsequent designation, Hooker, 1912: 134. [Junior homonym of *Ophiomorpha* Nilsson, 1836.]
Cryptocamptus Brèthes, 1909: 230. [Unnecessary replacement name for *Allocamptus* Foerster.]
Eremotyloides Perkins, 1915: 530. Type-species: *Eremotyloides orbitalis* Ashmead, by monotypy.
Amesospilus Enderlein, 1918: 222. Type-species: *Ophion unicallosus* Snellen, by original designation.
Schizospilus Seyrig, 1935: 79. Type-species: *Schizospilus divisus* Seyrig, by original designation.

Diagnosis. Slender to stout yellowish to brownish orange species, sometimes with black markings; wings hyaline or yellowish, rarely with infumate patch near pterostigma; fore wing length 6–28 mm. Mandibles relatively slender, weakly to strongly twisted; maxillae and labium unspecialized; clypeus convex to truncate, rarely slightly concave or medially produced; occipital carina complete or centrally interrupted. Notauli weak, vestigial or absent; mesopleural furrow, if discernible, extending from episternal scrobe to subalar prominence; posterior transverse carina of mesosternum complete or centrally interrupted. Fore wing generally with *Rs+2r* sinuous and usually with a large hairless area beneath it in the discosubmarginal cell, this hairless area often bears pigmented sclerites; pterostigma moderately stout to moderately slender; *1m-cu* sinuous or bowed; hind wing with *Rs* straight or weakly bowed; distal abscissa of *Cu*1 basally much closer to *1A* than it is to *M*. Gaster usually slender; second segment usually with epipleuron turned under, though rarely with it membranous and pendant; tergite 2 longer than tergite 3.

Remarks. *Enicospilus* is a very large and predominantly tropicopolitan genus. Recent study of extensive collections (in BMNH, CNC, TC) has revealed that there are at least 150 species in the Neotropical region. Many are widely distributed, though few occur in Chile and southern Argentina. Some species have reached the Galapagos Islands where a small radiation has apparently occurred (Gauld & Carter, 1983). The present study has found that 116 species occur in Mesoamerica, though this is likely to be a considerable underestimate of the true size of the region's fauna because many areas are still very poorly studied. For example, only 12 species have been collected in the Central American countries of Nicaragua, El Salvador and Honduras, whilst the fauna of the Darién region of Panama is almost unknown.

The Mesoamerican species can be assigned to five rather ill-defined species-groups. One of the most distinctive of these is the cosmopolitan *Enicospilus undulatus* species-group, which is characterized by the complete lack of a pigmented proximal sclerite, and by possessing a hook-like process on the gonolacinia. It includes some of the largest species in the genus. The *undulatus* species-group is most species-rich in tropical areas and it is well represented in the faunas of all tropical forests. Its New World subgroup, the *americanus* species-complex, comprises about 40 species. A few occur in North America (Gauld, 1988), but most are restricted to continental Central and South America. In Mesoamerica this group is represented by 27 species, but only one, the extremely widespread and rather aberrant species, *E. glabratus*, occurs in the Caribbean. Many of the species in this group are known to parasitize the larvae of saturniids.

The second group of species, the cosmopolitan *Enicospilus ramidulus* species-group, is represented in the New World by a complex of species that includes *E. purgatus* and its relatives. The group is characterized by possessing long slender mandibles with a deep diagonal groove extending from the upper corner to the base of the teeth. The *ramidulus* group is most species-rich in warm temperate and dry areas, and in the New World is best represented in the United States, northern Mexico, the Galapagos Islands, Chile and Argentina. Representatives of this group are relatively uncommon in humid tropical areas and it is represented in Mesoamerica by only three species. Throughout the world, many members of this species-group are known to occur in open areas, such as farmland, where they parasitize a range of grass- and herb-feeding noctuid caterpillars.

The third group of species here recognized is the *trilineatus* species-group which is characterized by having a more or less pendant laterotergite, a long labrum and stout mandibles. Many of its component species have flanged aedeagi. The *trilineatus* species-group is confined to the New World and it seems to be most diverse in Mesoamerica. Many of the species in this group are associated with open areas, and some are extremely vagile, having spread throughout the Caribbean and one even reaching the Galapagos islands.

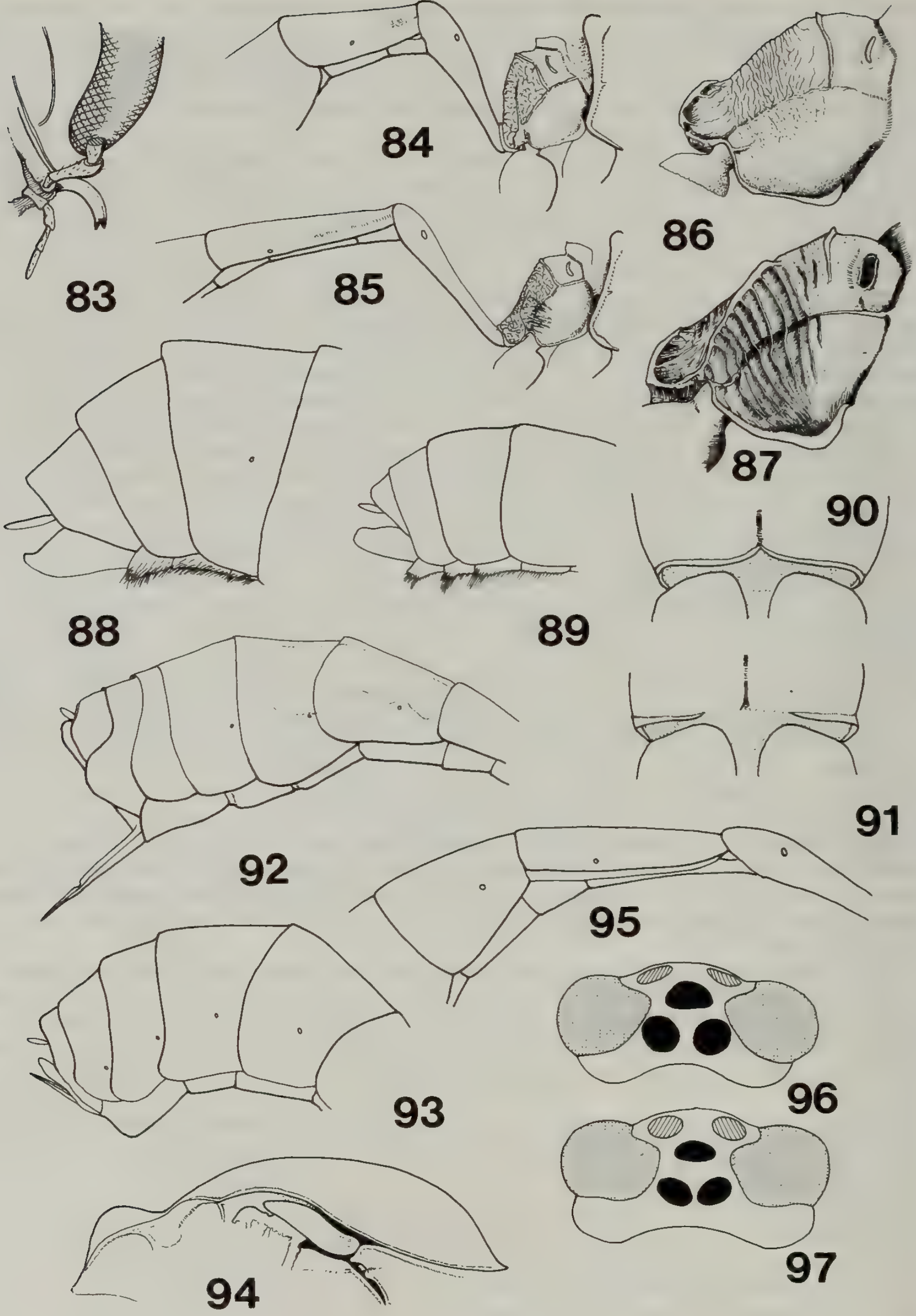
The fourth Mesoamerican group of species, the *columbianus* species-group, is characterized by having a very large lower mandibular tooth. It is endemic to the Neotropical realm and is represented in Central America by two uncommon species.

The fifth group of species recognized here is the *dispilus* species-group. This very large assemblage of taxa is really all the species of *Enicospilus* occurring in the New World that cannot be assigned to other groups. I do not doubt that the majority assigned to this group are actually closely related to each other, but some may represent separate evolutionary lineages. A striking feature of the Neotropical *Enicospilus* fauna is that very many of the species (here placed in this group) closely resemble each other and these may represent a fairly recent and explosive radiation of the genus into the New World. In the Old World tropics large numbers of very distinctive species-groups are recognizable (Gauld & Mitchell, 1978; 1981), and the morphological diversity of the genus as a whole far exceeds that of the New World representatives.

Key to the Mesoamerican species of *Enicospilus*

1 Fore wing without a clearly discernible proximal sclerite, at most with a weakly sclerotized, indistinctly defined vestige discernible (Figs 219–248)................................ 2

– Fore wing with a distinctly delineated and strongly pigmented proximal sclerite (Figs 249–352) 35



Figs 83–97 *Enicospilus* species. 83, *E. bozai*, posteroventral region of head. 84–85, propodeum and base of gaster, lateral view; (84) *E. enigmus*; (85) *E. chaconi*. 86, 87, propodeum, lateral view; (86) *E. major*; (87) *E. clarkorum*. 88, 89, terminal segments of gaster of male; (88) *E. major*; (89) *E. clarkorum*. 90, 91, posterior region of mesothorax, ventral view; (90) *E. mayi*; (91) *E. chiriquensis*. 92, 93, posterior segments of gaster of female; (92) *E. exoticus*; (93) *E. mexicanus*. 94, mesoscutum and scutellum in profile, *E. abelardoi*. 95, *E. mexicanus*, anterior part of gaster, lateral view. 96, 97, head, dorsal view; (96) *E. sarukhani*; (97) *E. halffteri*.

2 Fore wing with *Rs+2r* more or less straight (except for bend near proximal end), with posterior margin straight or very slightly convex (Figs 219–223) 3

– Fore wing with *Rs+2r* centrally weakly to strongly sinuous, its posterior margin concavely bowed or sinuous near proximal 0.2–0.4 (Figs 224–234) 8

3 Metapleuron granulate, matt (Fig. 149); genal carina ventrally abruptly turned to approach hypostomal carina at about 90°, but with extreme end evanescent (Fig. 83); occipital carina mediodorsally usually interrupted; fenestra often with a narrow glabrous extension distally that isolates a hirsute triangular area adjacent to *Rs+2r* (Fig. 219).

Male with terminal gastral sternites bearing dense stout erect pubescence (Fig. 147) **bozai** sp. n. (p. 123)

– Metapleuron punctate to striate (Fig. 150), often polished; genal carina ventrally gradually convergent with hypostomal carina, its lower end often strong and joining the hypostomal carina; occipital carina mediodorsally complete; fenestra without a glabrous distal extension (Figs 220–223) 4

4 Interocellar area uniformly black; female with tergite 7, in profile, strongly posteriorly concave, with a well-developed posteroventral lobe (Fig. 92); tergites 3–4 dorsally and ventrally infuscate, remainder pale yellowish; ovipositor sheath very stout. **exoticus** (Morley) (in part) (p. 216)

– Interocellar area not uniformly black, at most only dark between posterior ocelli; female with tergite 7 in profile posteriorly weakly concave, without a conspicuous posteroventral lobe (cf. Fig. 93); tergites 3–4 unicolorous; ovipositor sheath slender or moderately slender 5

5 Gaster stout, tergite 1 (immediately before spiracle) in profile deeper than broad; tergite 2 less than 3.0 times as long as posteriorly deep (Fig. 84); fenestra not extending to anterior corner of discosubmarginal cell (Fig. 220).

Male with terminal gastral sternites densely pubescent (Fig. 148) . . . . **enigmus** sp. n. (p. 124)

– Gaster slender, tergite 1 (immediately before spiracle) in profile as deep as or less deep than broad; tergite 2 more than 3.5 times as long as posteriorly deep (Fig. 85); fenestra with a narrow glabrous extension adjacent to *Rs+2r*, reaching to anterior corner of discosubmarginal cell (Figs 222–223) 6

6 Lower tooth of mandible ventrally swollen, shorter, but much stouter than the upper tooth (cf. Figs 120, 176); fore wing with *3rs-m* less than 1.05 times as long as abscissa of *M* between *2m-cu* and *3rs-m*; posterior transverse carina of mesosternum centrally discontinuous or incomplete (cf. Fig. 91) . . . . **chaconi** sp. n. (p. 125)

– Lower tooth of mandible not appreciably swollen ventrally, not distinctly stouter than the upper tooth; fore wing with *3rs-m* more than 1.05 and often more than 1.40 times as long as abscissa of *M* between *2m-cu* and *3rs-m* (Figs 222, 223); posterior transverse carina of mesosternum complete (cf. Fig. 90) 7

7 Female with hind tarsal claws with stout sparse pectination (Fig. 152); propodeum laterally with a crest, and usually with striae that extend onto metapleuron (Fig. 87); male with sternites 7–9 margined posteriorly by band of dense long stout erect hairs (Fig. 89). **clarkorum** sp. n. (p. 126)

– Female with hind tarsal claws with close fine pectination (Fig. 151); propodeum laterally without a crest, or with a weak one, but without striae extending on to metapleuron (Fig. 86); male with sternites 7–9 rather evenly closely pubescent (Fig. 88). . . . . . **major** (Morley) (p. 127)

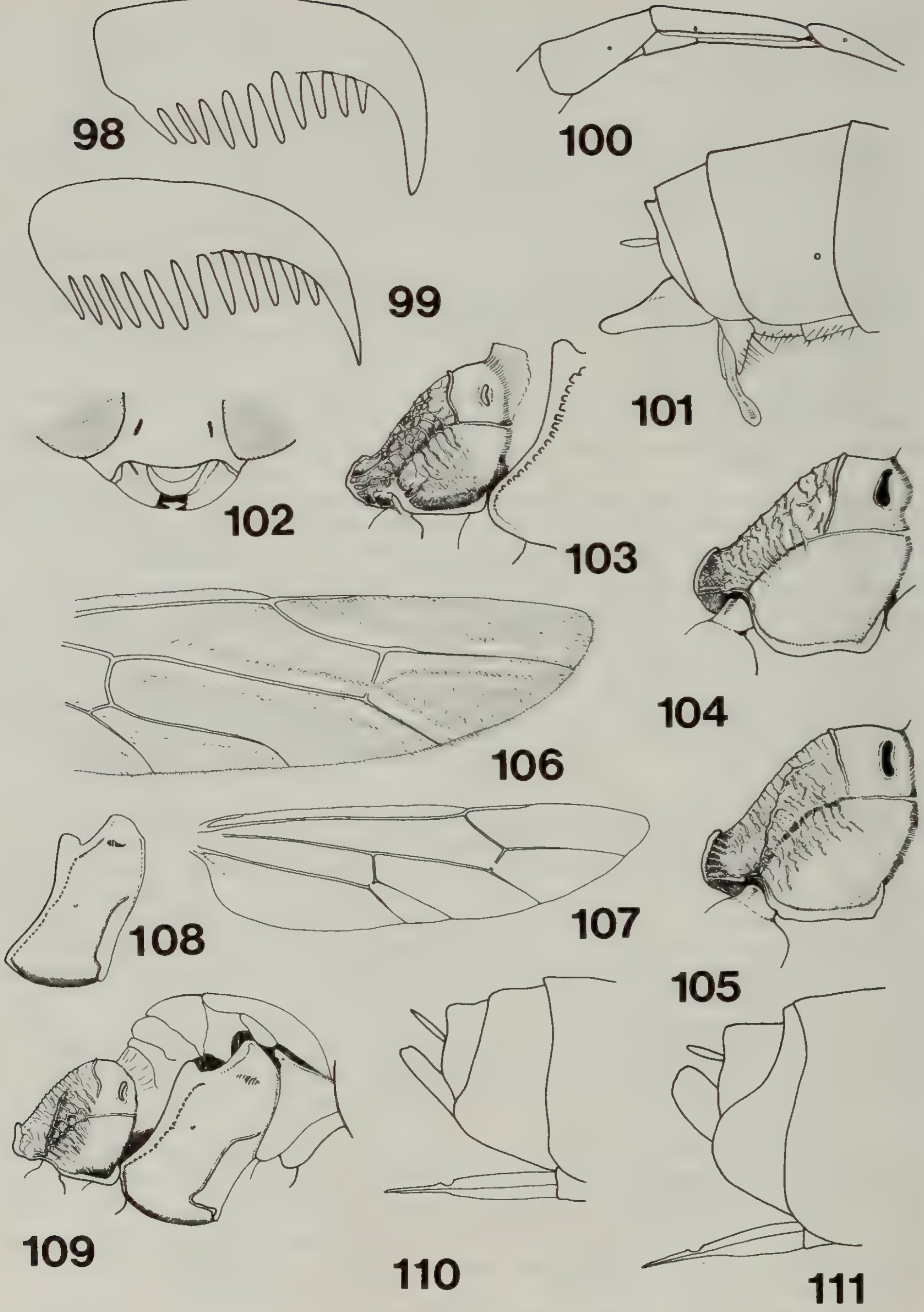
8 Fenestra extending proximally about to level of base of pterostigma (the 'hinge'), but not reaching anterior corner of discosubmarginal cell as this is occupied by a cluster of long, densely interspaced hairs (Fig. 224).

Genal carina strong, reaching hypostomal carina; fore wing usually with *1m-cu* evenly arcuate. . . . . **glabratus** (Say) (p. 128)

– Fenestra generally not extending proximal to base of *Rs+2r*, never with a patch of dense, long hair in anterior corner of discosubmarginal cell (Figs 225–248) 9

9 Propodeum with posterior transverse carina very strong, complete, parallel to anterior transverse carina and with area behind the posterior carina bearing rugae that radiate from gastral insertion (Fig. 153).

Clypeus flat, margin sharp; genal carina joining hypostomal carina. . . . **alvaroi** sp. n. (p. 131)



Figs 98–111 *Enicospilus* species. 98, 99, hind tarsal claws of female; (98) *E. americanus*; (99) *E. texanus*. 100, tergite 2, lateral, *E. trilineatus*. 101, aedeagus and male subgenital plate, *E. dirzoi*. 102, lower face in anterior view, *E. baltodanorum*. 103–105, metapleuron and propodeum, lateral view; (103) *E. porteri*; (104) *E. baltodanorum*; (105) *E. carri*. 106,107, distal part of hind wing; (106) *E. masneri*; (107) *E. exoticus*. 108, mesopleuron, *E. carri*. 109, alitrunk, lateral view, *E. colini*. 110, 111, apex of gaster of female, lateral view; (110) *E. pamelae*; (111) *E. stevensi*.

– Propodeum with posterior transverse carina absent, or if present then weak or incomplete centrally, at most as developed as in Fig. 154, and not parallel to the anterior transverse carina; area behind this carina irregularly sculptured, sometimes concentrically rugose-striate. 10

10 Fore wing with fenestra very small, its maximum diameter subequal to or less than length of *3rs-m* (Figs 226, 227); *3rs-m* more than 1.00 times as long as abscissa of *M* between *2m-cu* and *3rs-m* 11

– Fore wing with fenestra moderately large to very large, its maximum diameter greater than length of *3rs-m*; (Figs 228-234); *3rs-m* various, often less than 1.00 times as long as abscissa of *M* between *2m-cu* and *3rs-m* 12

11 Posterior transverse carina of mesosternum complete (Fig. 90); base of antenna black dorsally; male with sternites 7–9 bearing fine, semidecumbent pubescence (Fig. 155). ***mayi*** sp. n. (p. 132)

– Posterior transverse carina of mesosternum broadly interrupted centrally (Fig. 91); antenna basally brownish; male with sternites 7–9 bearing long stout erect pubescence (Fig. 156). ***chiriquensis*** (Cameron) (p. 134)

12 Mandible twisted 45° or more (Fig. 158); *either* with fore wing with abscissa of *Cu*1 between *1m-cu* and *Cu*1a more than 0.70 times as long as *Cu*1b (Fig. 229), *or* with propodeum with anterior transverse carina incomplete and posterior area weakly sculptured, *or* both. ***brevis*** (Morley) (p. 136)

– Mandible usually twisted less than 35° (Fig. 157), *or* if rarely slightly more twisted (up to 60°) then both with fore wing with abscissa of *Cu*1 between *1m-cu* and *Cu*1a less than 0.70 times as long as *Cu*1b, and with posterior area of propodeum strongly sculptured and delineated anteriorly by a strong transverse carina (Figs 159, 160) 13

13 Fenestra with a large, quite strongly sclerotized subtriangular central sclerite that is paralleled proximally by a weaker crescentic sclerite (Fig. 228).

Fore wing with *Rs+2r* strongly sinuate, proximally almost parallel to hind margin of pterostigma; *1m-cu* fairly evenly and steeply arcuate .... ***robertoi*** sp. n. (p. 137)

– Fenestra with central sclerite weakly sclerotized, indistinctly delineated, or if rarely stronger then small and elliptical and not paralleled proximally by a weaker crescentic sclerite (Figs 230–248) 14

14 Fore wing with *Rs+2r* very strongly sinuous, with anterior margin of proximal part of vein parallel to hind margin of pterostigma *and* with *3rs-m* less than 0.65 times as long as abscissa of *M* between *2m-cu* and *3rs-m* (Fig. 230).

Fenestra with an indistinctly delineated central fleck; pale yellowish brown species that usually has mesoscutal vittae and tergites 3+ infuscate. .... ***scuintlei*** sp. n. (p. 140)

– Either with fore wing with *Rs+2r* less strongly sinuous, so that anterior margin of proximal part of vein is convergent with hind margin of pterostigma, *or* with *3rs-m* more than 0.65 times as long as abscissa of *M* between *2m-cu* and *3rs-m* (Figs 231–248) 15

15 Tergite 2 with laterotergite pendant for all or the greater part of its length (Fig. 95).

Female with subgenital plate very large and conspicuous, longer than sternite 5 (Fig. 93); fore wing with *3rs-m* more than 0.85 times as long as abscissa of *M* between *2m-cu* and *3rs-m* (Fig 231). .... ***mexicanus*** (Cresson) (p. 142)

– Tergite 2 with laterotergite folded under for all or the greater part of its length 16

16 Flagellum dorsally more or less entirely blackish, especially in proximal half. 17

– Flagellum yellowish brown, at most weakly to moderately infuscate at extreme base. 21

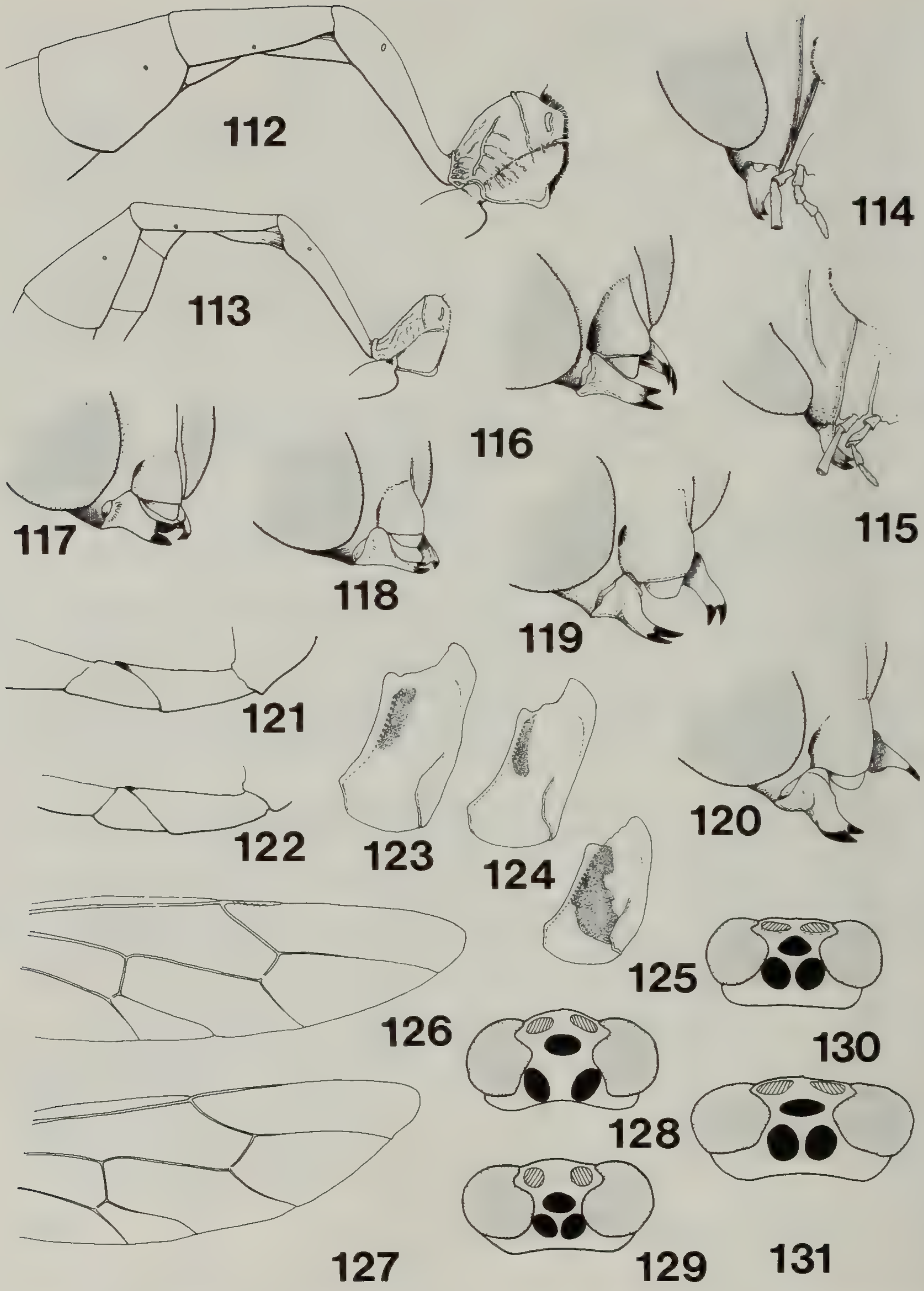
17 Fore wing with *Rs+2r* very weakly sinuate (Figs 232, 233) 18

– Fore wing with *Rs+2r* moderately strongly sinuate (Figs 234–241). 19

18 Scutellum in profile pyramidal, anteriorly raised higher than plane of mesoscutum, posteriorly abruptly declivous (Fig. 94); fore wing *3rs-m* less than 0.90 times as long as abscissa of *M* between *2m-cu* and *3rs-m* (Fig. 232); very large species, fore wing length 23+ mm. ***abelardoi*** sp. n. (p. 145)

– Scutellum in profile weakly to moderately convex, posteriorly always weakly rounded; fore wing *3rs-m* more than 0.95 times as long as abscissa of *M* between *2m-cu* and *3rs-m* (Fig. 233); smaller species, fore wing length 15–18 mm. .... ***hallwachsae*** sp. n. (in part) (p. 146)

19 Distal margin of fenestra reaching almost to base of *Rs*; fenestra usually margined peripherally by a weak, broadly U-shaped sclerite (Fig. 241). .... ***gomezpompai*** sp. n. (in part) (p. 157)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Figs 112–131 *Enicospilus* species. 112, 113, anterior part of gaster; (112) *E. maritzai*; (113) *E. hacha*. 114, 115, head, posteroventral view; (114) *E. xanthostigma*; (115) *E. cepillo*. 116–120, head, lateral view; (116) *E. teodorae*; (117) *E. cepillo*; (118) *E. xanthostigma*; (119) *E. hacha*; (120) *E. corcovadoi*. 121,122, hind trochanteral segments; (121) *E. cepillo*; (122) *E. xanthostigma*. 123–125, mesopleuron, showing extent of dark marking; (123) *E. oduberi*; (124) *E. pescadori*; (125) *E. sanchezi*. 126, 127, hind wing; (126) *E. pescadori*; (127) *E. sanchezi*. 128–131, head, dorsal view; (128) *E. liesneri*; (129) *E. gallegosi*; (130) *E. corcovadoi*; (131) *E. hacha*.

– Distal margin of fenestra separated from base of *Rs* by more than 0.5 of the length of *3rs-m*; fenestra not margined by a broadly U-shaped sclerite (Figs 234, 235) 20

20 Central flagellar segments less than 2.0 times as long as broad; male with sternites 7–9 bearing dense long erect pubescence; propodeum with a strong lateral keel formed by the posterior transverse carina (Fig. 159)............................... ***cameronii*** (Dalla Torre) (p. 147)

– Central flagellar segments 2.0 or more times as long as broad; male with sternites 7–9 bearing fine, rather decumbent pubescence; propodeum without a keel, lacking any trace of the posterior transverse carina (Fig. 160) .... ***gamezi*** sp. n. (p. 150)

21 Hind tarsal claws long and apically evenly curved through about 60° (Fig. 99); face subquadrate to transverse, that of male more than 0.90 times, and that of female more than 0.85 times as broad as high.
Northern American species 22

– Hind tarsal claws moderately long, apically quite abruptly curved through 85–90+° (Fig. 98); face from elongate to subquadrate, that of male less than 0.90 times, and that of female usually less than 0.85 times as broad as high.. 23

22 Larger species, fore wing length 15+ mm, wings weakly to strongly infumate (Fig. 236); mandibles long, distally parallel sided; lateral longitudinal carina of propodeum not present behind anterior transverse carina .... ***texanus*** (Ashmead) (p. 151)

– Smaller species, fore wing length 10–15 mm, wings hyaline (Fig. 237); mandibles rather short, evenly tapered; lateral longitudinal carina of propodeum usually complete.
cushmani Gauld (p. 153)

23 Fore wing with *Rs+2r* very weakly sinuate (Figs 238, 239) 24

– Fore wing with *Rs+2r* moderately to strongly sinuate (Figs 241–248) 27

24 Scutellum with lateral longitudinal carinae present only at extreme anterior end; genae distinctly buccate (Fig. 97); fore wing with *1m-cu* distal to bulla 0.56 times as long as *3s-m* (Fig. 238).
Male with posterior sternites bearing fine decumbent pubescence.... ***halffteri*** sp. n. (p. 154)

– Scutellum with lateral longitudinal carinae extending at least 0.5 of its length; genae evenly rounded behind eye (Fig. 96); fore wing with *1m-cu* distal to bulla more than 0.75 times as long as *3rs-m* (Fig. 239). Male, where known, with posterior sternites bearing long stout erect pubescence 25

25 Propodeum with posterior area immediately behind the anterior transverse carina smooth and polished, and with anterior and spiracular areas forming a broad shallow groove; postscutellum with a median longitudinal keel. .... ***sarukhani*** sp. n. (p. 155)

– Propodeum with posterior area coarsely sculptured right up to anterior transverse carina, and with anterior and spiracular areas forming a short, deeply U-shaped groove (Fig. 161); postscutellum without a distinct median longitudinal keel. 26

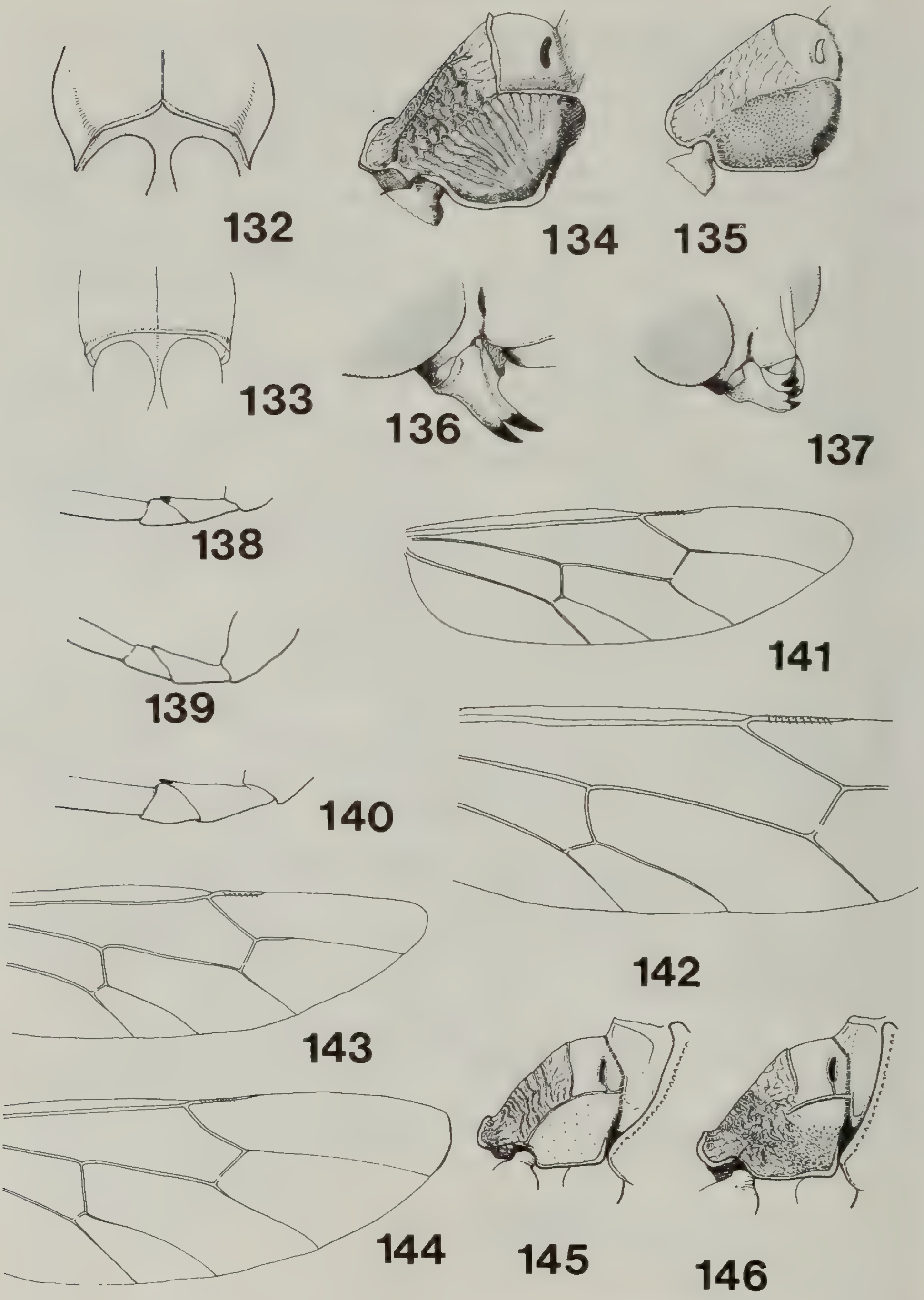
26 Fore wing with fenestra bearing a weakly sclerotized, oval or elliptical mark centrally; 2nd discal cell not exceptionally elongate, with abscissa of *Cu*1a between *Cu*1b and *2m-cu* less than 1.35 times as long as first abscissa of *Cu*1 (Fig. 240); a pallid yellow species. ***aktites*** Gauld (p. 156)

– Fore wing with fenestra more or less hyaline, without a sclerotized elliptical or oval mark; 2nd discal cell very elongate, with abscissa of *Cu*1a between *Cu*1b and *2m-cu* more than 1.35 times as long as first abscissa of *Cu*1 (Fig. 233); a darker yellowish brown species.
hallwachsae sp. n. (in part) (p. 146)

27 Fenestra very large, reaching close to junction of *Rs* and *3rs-m*, margined peripherally by a weak and broadly U-shaped sclerite (Fig. 241); abscissa of *1m-cu* distal to bulla short, 0.50–0.75 times as long as *3rs-m*; *1m-cu* quite evenly bowed.
Propodeum with anterior area long, almost smooth; posterior area with weak irregular sculpture (Fig. 162). .... ***gomezpompai*** sp. n. (in part) (p. 157)

– Fenestra usually smaller, its margin not close to junction of *Rs* and *3rs-m*, or if close, then without a peripheral U- shaped sclerite (Figs 242–248); sclerite otherwise present or absent, usually the latter; abscissa of *1m-cu* distal to bulla of various lengths, usually more than 0.80 times as long as *3rs-m*; *1m-cu* from fairly evenly bowed to sinuous 28

28 Fore wing with fenestra bearing two distinct, similar-sized weakly sclerotized quadrae (Fig. 242).
Male with sternites 7–9 bearing long stout erect pubescence (Fig. 163); clypeus in profile flat.. ***lebophagus*** Gauld (p. 160)



Figs 132–146 *Enicospilus* species. 132, 133, posterior part of mesothorax, ventral view; (132) *E. guindoni*; (133) *E. leoni*. 134, 135, metapleuron and propodeum, lateral view; (134) *E. erasi*; (135) *E. brenesiae*. 136, 137, lower part of head and mandibles, lateral view; (136) *E. erasi*; (137) *E. brenesiae*. 138–140, hind trochanteral segments; (138) *E. burgosi*; (139) *E. gallegosi*; (140) *E. dispilus*. 141–144, hind wing; (141) *E. masoni*; (142) *E. howdenorum*; (143) *E. dispilus*; (144) *E. georginae*. 145, 146, metapleuron and propodeum, lateral view; (145) *E. howdenorum*; (146) *E. sondrae*.

– Fore wing with fenestra without quadrae, or with one quadra discernible (Figs 243–248) 29

29 Fenestra quite long, its distal side separated from base of *Rs* by about length of *3rs-m* (Fig. 243); genal carina more or less reaching hypostomal carina; apex of clypeus truncate to slightly concave (Fig. 164).
Male with sternites 7–9 bearing long stout erect hairs; female with ovipositor sheath paler brownish, only slightly infuscate apically .... ***ugaldei*** sp. n. (p. 161)

– Fenestra short, its distal side separated from base of *Rs* by more than length of *3rs-m* (Figs 244–248); genal carina ventrally evanescent, not reaching hypostomal carina; apex of clypeus from weakly convex to almost truncate 30

30 Metapleuron characteristically convex posterodorsally, flattened anteroventrally (Fig. 165); propodeum with posterior area dorsally irregularly rugose to reticulate, never concentrically rugose/striate.
Male with sternites 7–9 bearing fine scattered erect hairs .... ***umanai*** sp. n. (p. 164)

– Metapleuron evenly convex, not anteroventrally flattened (Fig. 165); propodeum with posterior area concentrically rugose/striate, at least near posterior end..................... 31

31 Fore wing with *3rs-m* conspicuously longer than abscissa of *M* between *3rs-m* and *2m-cu* (Fig. 245).
Male with sternites 7–9 bearing stout erect hairs.................. ***quintanai*** sp. n. (p. 165)

– Fore wing with *3rs-m* shorter than abscissa of *M* between *3s-m* and *2m-cu* (Figs 247–248).... 32

32 Antenna with central segments 1.7 or less times as long as broad; clypeus in profile weakly to strongly out-flared and with genae somewhat swollen. Mainly present in extra- tropical areas.
americanus (Christ) (p. 166)

– Antenna with central segments 1.8 or more times as long as broad; clypeus in profile generally flat to weakly convex, if slightly out-flared then genae not swollen; genae otherwise from rounded to somewhat swollen behind eyes. Tropical species.......................... 33

33 Male with subgenital plate conspicuously longer than the preceding sternite (Fig. 167); metapleuron finely and closely striate (Fig. 166); mandibles of moderate length, fairly evenly narrowed (Fig. 168)................................ ***tenuigena*** (Kriechbaumer) (p. 168)

– Male with subgenital plate shorter than the preceding sternite; metapleuron punctate to punctostriate mandibles long, stout, distally parallel sided............................. 34

34 Genal carina ventrally strong, joining hypostomal carina; male with hind tarsal claws very abruptly curved with long apical point; sternites 7–9 of male bearing close, long stout erect hairs .... ***venezuelanus*** (Szépligeti) (p. 169)

– Genal carina ventrally evanescent, not joining hypostomal carina; male with hind tarsal claws unusually long, quite abruptly curved, but with short apical point; sternites 7–9 of male bearing fine scattered semierect pubescence.
Fore wing with *Rs+2r* bearing a sharp angulation ventrally near proximal 0.2 (Fig. 248).
peigleri Gauld (p. 170)

35 Outer surface of mandible with an impressed diagonal furrow extending from near upper proximal corner to between bases of apical teeth, this groove bearing close pubescence (Fig. 171) 36

– Outer surface of mandible flat, weakly convex or slightly concave, never with a distinct hirsute diagonal furrow (Figs 172, 176), but occasionally with a shallow longitudinal furrow (Fig. 217) which does not bear hairs.. 38

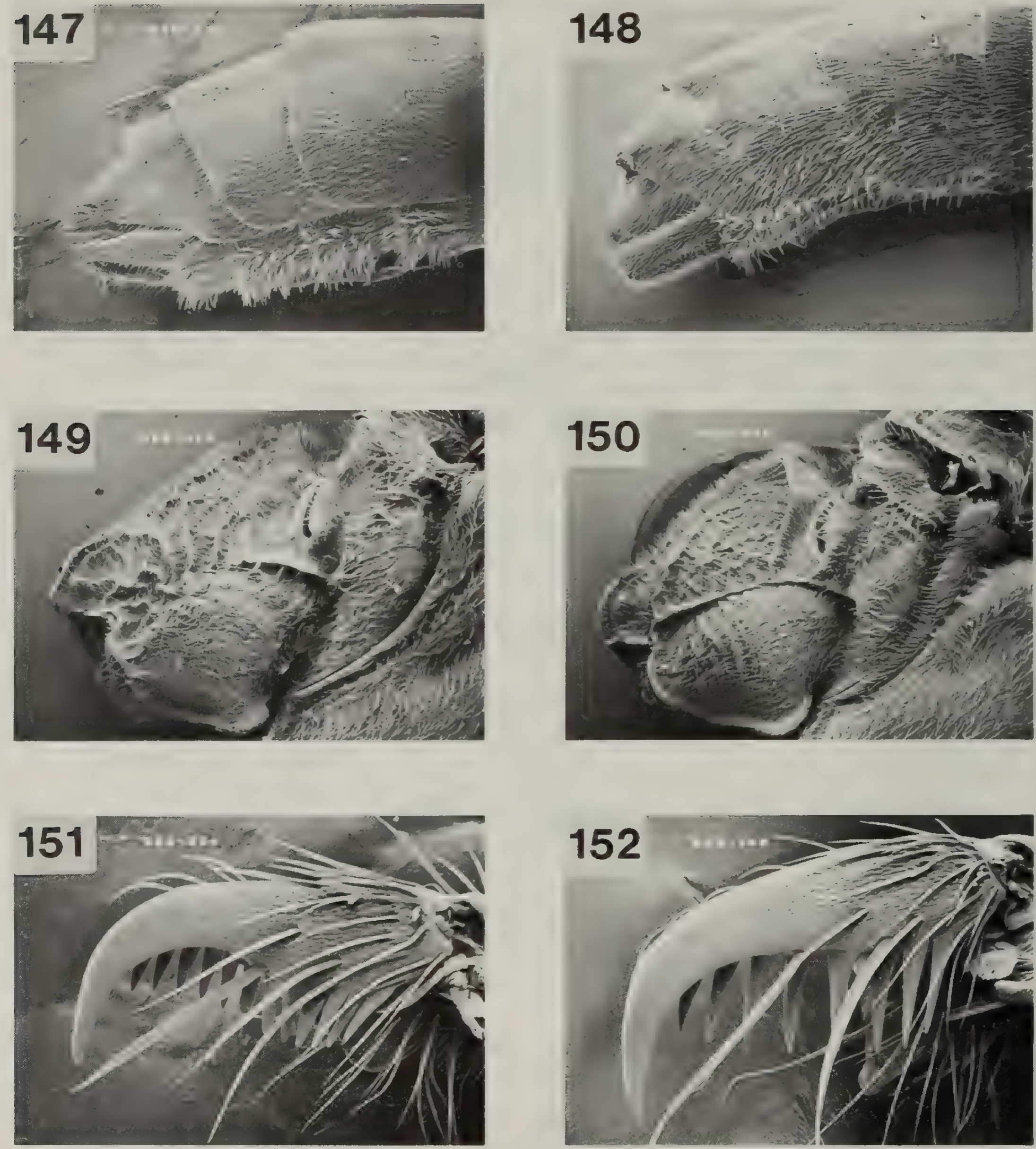
36 Fore wing with central sclerite entirely absent; vein *Rs+2r* centrally evenly bowed forwards (Fig. 249).. ***neotropicus*** Hooker (p. 172)

– Fore wing with a well-defined central sclerite; vein *Rs+2r* more or less straight or weakly sinuous (Figs 250, 251) 37

37 Metapleuron anteroventrally flattened (Fig. 169); fore wing with central sclerite more or less kite-shaped, with proximal side pointed and weakly sclerotized (Fig. 250).
doylei sp. n. (p. 173)

– Metapleuron rather evenly convex (Fig. 170); fore wing with central sclerite subcircular to D-shaped, the inner side convex or straight, strongly sclerotized (Fig. 251).
purgatus (Say) (p. 175)

38 Central sclerite present but confluent with the distal sclerite (Fig. 252).... ***luquillo*** sp. n. (p. 179)



Figs 147–152 *Enicospilus* species. 147, 148, subgenital plate of male; (147) *E. bozai*; (148) *E. enigmus*. 149, 150, metapleuron and propodeum, lateral view; (149) *E. bozai*; (150) *E. enigmus*. 151, 152, hind tarsal claws of female; (151) *E. major*; (152) *E. clarkorum*.

– Central sclerite absent or, if present, separated from the distal sclerite 39

39 Mandible with upper tooth about 0.7 or less times as long as the lower tooth (Fig. 172), *and* with clypeus in profile weakly convex 40

– Mandible with upper tooth subequal to or longer than the lower tooth *or*, if slightly shorter, then with clypeus in profile exceptionally convex (Fig. 116) 41

40 Fore wing with central sclerite vestigial, indistinctly differentiated (Fig. 253); *3rs-m* less than 0.45 times as long as abscissa of *M* between *2m-cu* and *3rs-m*; flagellum with 60 or fewer segments .... ***martae*** sp. n. (p. 180)

– Fore wing with central sclerite oval, fairly weakly sclerotized, but distinctly delineated (Fig. 254); *3rs-m* more than 0.60 times as long as abscissa of *M* between *2m-cu* and *3rs-m*; flagellum with 64–65 segments. .... ***columbianus*** (Enderlein) (p. 180)

41 Second gastral segment with laterotergite narrow, membranous and, for at least anterior half pendant (Fig. 100) *and* mandibles rather weakly narrowed and twisted less than 45°; labrum rather long, generally 0.4 or more as long as basally broad (Fig. 174).
Interocellar area often black. (*trilineatus* species-group) 42

– Second gastral segment with laterotergite folded under the tergite, at most just visible anteriorly or near hind end, (*except* in a rare species which has mandibles twisted 70°+); labrum various, generally less than 0.4 times as long as basally broad (Fig. 173) 49

42 Central sclerite crescentic, positioned close to a slender proximal sclerite which is of only slightly larger surface area (Fig. 255). .... ***cubensis*** (Norton) (most specimens) (p. 183)

– Central sclerite, if discernible not crescentic and much smaller than proximal sclerite (Figs 256–261) 43

43 Fore wing with 2nd subdiscal cell with a glabrous arc behind vein *Cu*1a (Figs 256, 257); *Cu*1b dorsally bearing a few very long fine hairs; abscissa of *Cu*1 between *1m-cu* and *Cu*1a more than 0.65 times as long as *Cu*1b. 44

– Fore wing with 2nd subdiscal cell more or less evenly hirsute (Figs 258–261); *Cu*1b without exceptionally long hairs on its dorsal surface; abscissa of *Cu*1 between *1m-cu* and *Cu*1a less than 0.60 times as long as *Cu*1b. 45

44 Fore wing with distal sclerite subtriangular; *1m-cu* centrally slightly angulate (Fig. 256). Cuban species. .... ***carlota*** sp. n. (p. 185)

– Fore wing with distal sclerite obovate; *1m-cu* very evenly bowed (Fig. 257). Hispaniolan species.. .... ***dajaboni*** sp. n. (p. 186)

45 Interocellar area yellowish; fore wing usually with proximal sclerite subcircular, and generally with distal sclerite elliptical, with its longest axis parallel to *Rs+2r*
trilineatus (Brullé) (in part) (p. 189)

– Interocellar area black; fore wing with proximal sclerite more or less triangular, distal sclerite absent, or if present, then usually not elliptical and with longest axis parallel to *Rs+2r*. . . . 46

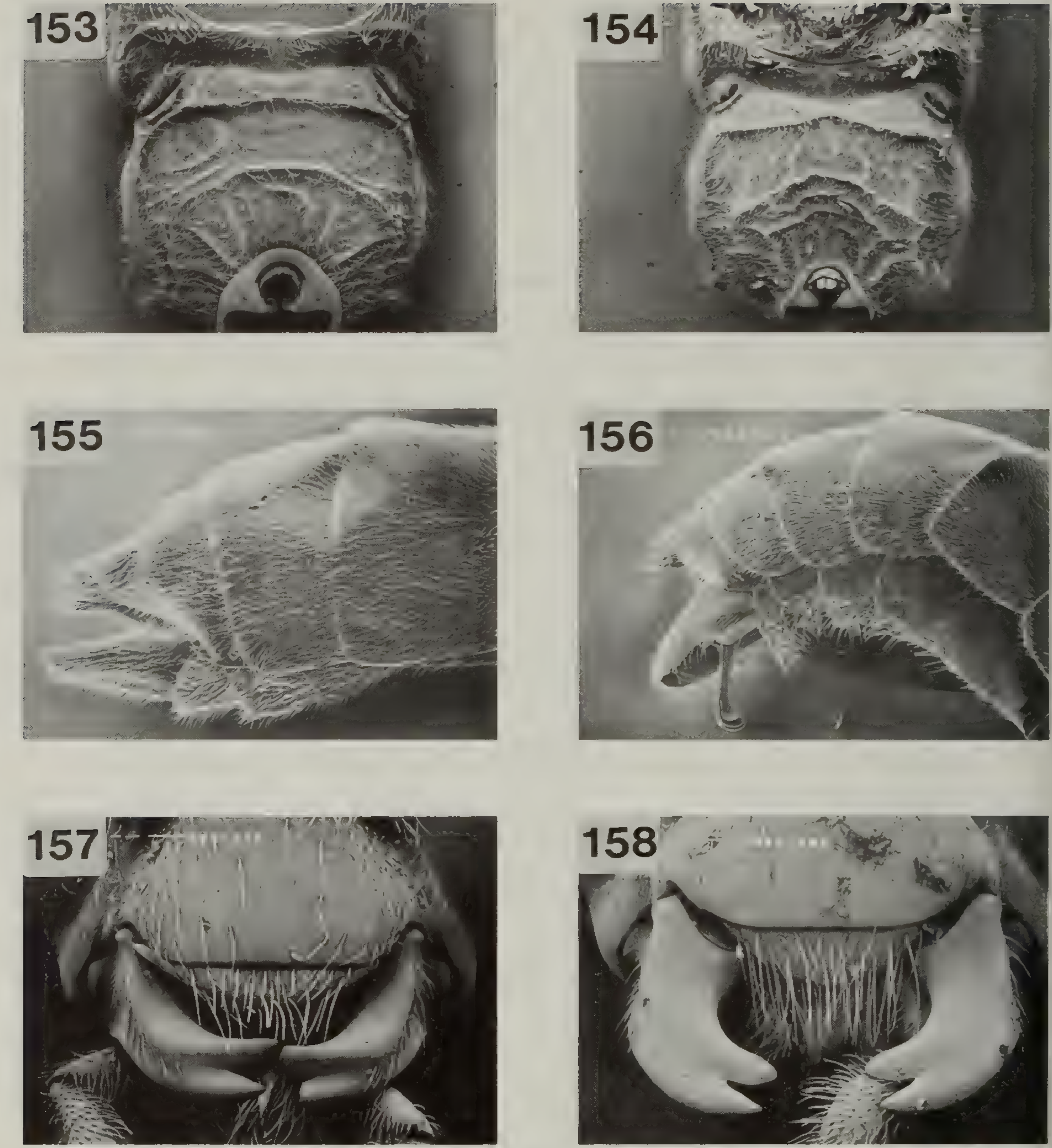
46 Central sclerite oval, weak, positioned close to distal margin of the fenestra (Fig. 258); male with sternites 7–9 bearing dense long pubescence.
Metapleuron dorsally coarsely rugose (Fig. 103); central flagellar segments more than 2.9 times as long as broad .... ***porteri*** sp. n. (p. 187)

– Central sclerite absent, or if present then positioned at or proximal to centre of fenestra (Figs 259–261); male with sternites 7–9 bearing fine semidecumbent pubescence (Fig. 101) 47

47 Fore wing with proximal sclerite narrow, very strongly acute anteriorly (Fig. 259); alitrunk extensively black-marked especially on mesoscutum and mesosternum.
lupemejia sp. n. (p. 188)

– Fore wing with proximal sclerite rounded anteriorly *or*, if acute, then entire sclerite is almost equilaterally triangular (Figs 260, 261); alitrunk generally not black- marked, rarely with an infuscate mark on mesoscutum centrally 48

48 Male with aedeagus bearing a distinct collar (Fig. 175); *either* with hind trochantellus less than 0.2 times as long as broad mediodorsally, *and/or* with metapleuron coriaceous to striate.
trilineatus (Brullé) (in part) (p. 189)



Figs 153–158 *Enicospilus* species. 153, 154, propodeum, dorsal view; (153) *E. alvaroi*; (154) *E. chiriquensis*; 155, 156, subgenital plate of male; (155) *E. mayi*; (156) *E. chiriquensis*. 157, 158, mandibles; (157) *E. robertoi*; (158) *E. brevis*.

– Male with aedeagus without a distinct collar, at most only with lateral flanges (Fig. 101); hind trochantellus 0.4 times as long as broad mediodorsally *and* metapleuron polished, punctate ***dirzoi*** sp. n. (p. 194)

49 Central sclerite absent, or with only an indistinct, unpigmented thickening present in fenestra (Figs 262–277)........ 50
– Central sclerite present, distinctly pigmented (Figs 278- 352)........ 67

50 Interocellar area uniformly black or dark brown........ 51
– Interocellar area yellowish, at most with a black mark between the posterior ocelli........ 54
[Intermediate specimens will key either way]

51 Cells in distal part of both fore and hind wings with broad glabrous areas adjacent to veins (Figs 106, 262); fore wing with proximal corner of marginal cell infumate; outer hind corner of 2nd discal cell very acute (Fig. 262); hind wing with abscissa of *Rs* between *R* and *rs-m* more than 2.2 times as long as *rs-m*, bowed; distal abscissa of *Cu*1 strongly sinuate ***masneri*** sp. n. (p. 195)
– Cells in distal part of fore and hind wings more or less uniformly hirsute (Figs 263, 264); fore wing with proximal corner of marginal cell not infumate; outer hind corner of 2nd discal cell obtuse or about a right-angle (Figs 263, 264); hind wing with abscissa of *Rs* between *R* and *rs-m* less than 2.2 times as long as *rs-m*, more or less straight (Fig. 107); distal abscissa of *Cu*1 straight, bowed or weakly sinuate........ 52

52 Fore wing with vein 3*rs-m* equal to or longer than abscissa of *M* between 2*m-cu* and 3*rs-m* (Fig. 221); gaster stout, tergite 2 in profile about 2.5 times as long as posteriorly deep (cf. Fig. 112); female with ovipositor sheath very stout. .... ***exoticus*** (Morley) (few specimens) (p. 216)
– Fore wing with vein 3*rs-m* less than 0.6 times the length of *M* between 2*m-cu* and 3*rs-m* (Figs 263, 264); gaster slender, tergite 2 in profile more than 4.5 times as long as deep posteriorly; female with ovipositor sheath slender........ 53

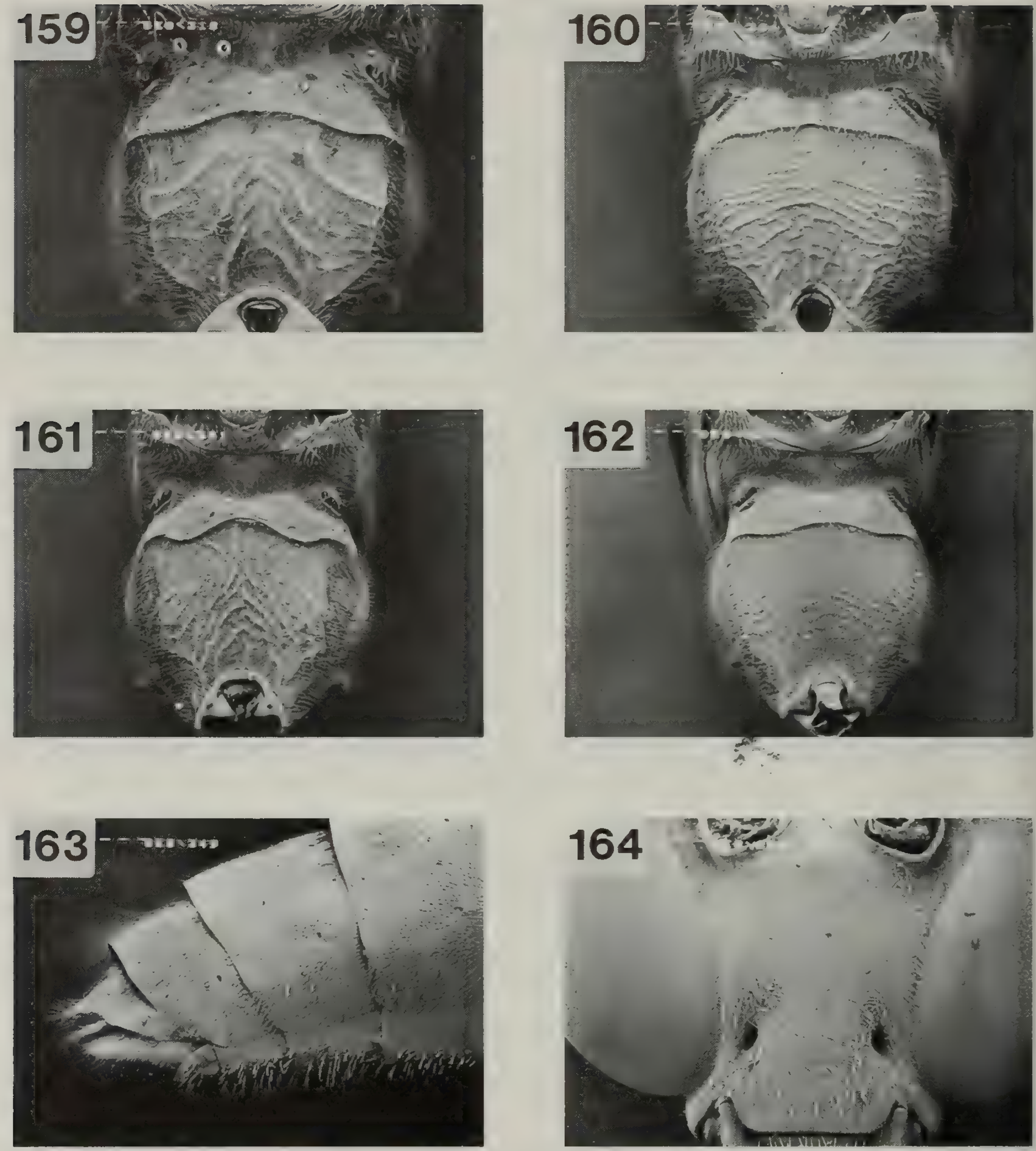
53 Fore wing with *Rs+2r* virtually straight; fenestra short; distal sclerite absent; first abscissa of *Cu*1a more than 1.10 times as long as first abscissa of *Cu*1 (Fig. 263).
randalli sp. n. (most specimens) (p. 196)
– Fore wing with *Rs+2r* slightly sinuate; fenestra moderately long; distal sclerite weak but discernible; first abscissa of *Cu*1a less than 1.05 times as long as first abscissa of *Cu*1 (Fig. 264)........ ***cressoni*** Hooker (in part) (p. 198)

54 Lower tooth of mandible broader than the upper tooth and ventrally swollen, with ventral margin sharp (Fig. 176); mandible twisted 20–30°.
Reddish brown species with tergites 3+ black........ 55
– Lower tooth of mandible of similar breadth to, or more slender than the upper, or if broader then the ventral margin lacks a sharp ventral margin and the mandibular apex is twisted more than 50°; mandible otherwise variously twisted........ 56

55 Metapleuron regularly punctate (Fig. 177); fore wing with 3*rs-m* more than 1.00 times as long as abscissa of *M* between 2*m-cu* and 3*rs-m* (Fig. 265); distal sclerite obsolescent, if discernible confluent with proximal sclerite; posterior transverse carina of mesosternum weak or incomplete centrally........ ***laurenae*** sp. n. (p. 199)
– Metapleuron posterodorsally striate (Fig. 178); fore wing with 3*rs-m* less than 1.00 times as long as abscissa of *M* between 2*m-cu* and 3*rs-m* (Fig. 266); distal sclerite discernible distally, not confluent with proximal sclerite; posterior transverse carina of mesosternum complete.
vegai sp. n. (p. 200)

56 Fore wing with 3*rs-m* more than 0.75 times as long as abscissa of *M* between 3*rs-m* and 2*m-cu* (Figs 267–269)........ 57
– Fore wing with 3*rs-m* less than 0.70 times as long as abscissa of *M* between 3*rs-m* and 2*m-cu* (Figs 270–274)........ 59

57 Proximal sclerite barely broader than and confluent with a similarly sclerotized distal sclerite (Fig. 267); mandible twisted less than 45°; lateral crest of propodeum absent. (Fig. 104).
baltodanorum sp. n. (p. 201)
– Proximal sclerite very much broader than and far more strongly sclerotized than distal sclerite (Figs 268, 269); mandible twisted 45° or more; propodeum with a weak to strong lateral crest (Fig. 105)........ 58



Figs 159–164 *Enicospilus* species. 159–162, propodeum, dorsal view; (159) *E. cameronii*; (160) *E. gamezi*; (161) *E. aktites*; (162) *E. gomezpompai*. 163, subgenital plate of male, *E. lebophagus*. 164, face, *E. ugaldei*.

58 Fore wing with *3rs-m* less than 1.20 times as long as abscissa of *M* between *3rs-m* and *2m-cu* (Fig. 268); occipital carina mediodorsally complete, strong; ventral corner of epicnemial carina rounded (Fig. 108); hind tarsal claws long .... ***carri*** sp. n. (p. 202)
– Fore wing with *3rs-m* more than 1.30 times as long as abscissa of *M* between *3rs-m* and *2m-cu* (Fig. 269); occipital carina mediodorsally incomplete or weak; ventral corner of epicnemial carina usually extended backwards slightly and acutely angled (Fig. 109); hind tarsal claws short.. ***colini*** sp. n. (p. 203)

59 Fore wing with marginal cell proximally strongly infumate; abscissa of *Cu*1 between *1m-cu* and *Cu*1a more than 0.40 times as long as *Cu*1b (Fig. 270); pterostigma centrally black, proximally and distally yellow.................................... ***maculipennis*** (Cameron) (p. 205)
– Fore wing with marginal cell hyaline or uniformly weakly infumate; abscissa of *Cu*1 between *1m-cu* and *Cu*1a less than 0.35 times as long as *Cu*1b (Figs 271–274); pterostigma orange or unicolorous brownish 60

60 Fore wing with *Rs+2r* bowed for most of its length (Fig. 271); fenestra long, reaching close to the junction of *Rs+2r* and *Rs* .... ***guatemalensis*** (Cameron) (p. 206)
– Fore wing with *Rs+2r* straight or sinuous (Figs 272–274); fenestra shorter, its distal margin separated from base of *Rs* by length of *3rs-m* or more 61

61 Fore wing with first abscissa of *Cu*1a equal in length or shorter than abscissa of *Cu*1 between *Rs&M* and *1m-cu* (Fig. 264); hind wing with first abscissa of *Rs* weakly but distinctly bowed (cf. Fig. 127), *and* with distal sclerite separated from proximal sclerite.
cressoni Hooker (in part) (p. 198)
– Fore wing with first abscissa of *Cu*1a 1.05 or more times as long as abscissa of *Cu*1 between *Rs&M* and *1m-cu* (Figs 272- 274); hind wing with first abscissa of *Rs* straight *or*, if weakly bowed, then distal sclerite confluent with proximal sclerite; distal sclerite otherwise various 62

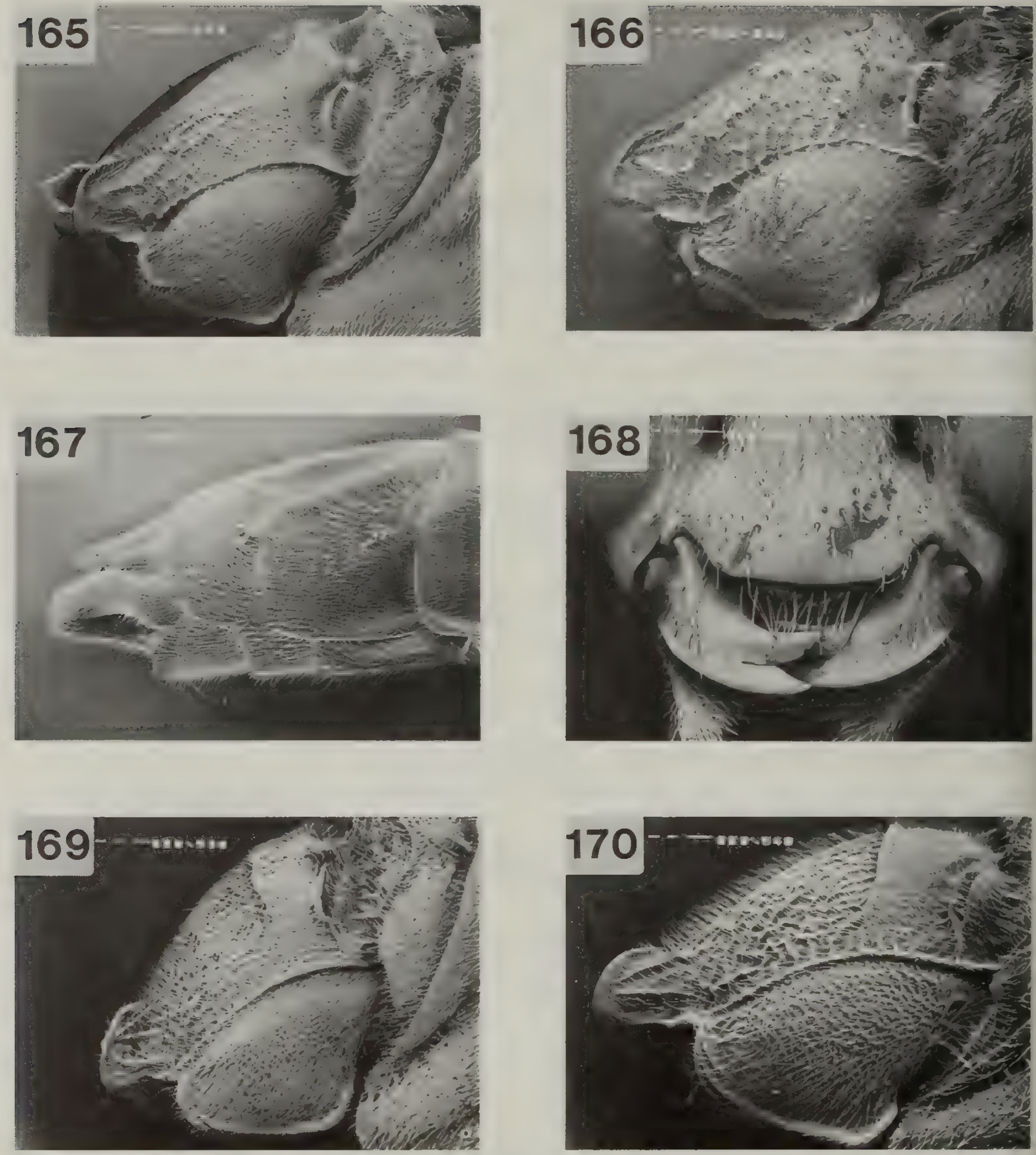
62 Posterior transverse carina of mesosternum broadly incomplete centrally; margin of clypeus truncate (Fig. 179) or even slightly concave; antennae golden; small species, fore wing length less than 13 mm .... ***karrensis*** sp. n. (p. 209)
– Posterior transverse carina of mesosternum complete or rarely weak centrally; margin of clypeus slightly convex (Fig. 180); antennae basally blackish or dark brown; larger species, fore wing length greater than 13 mm 63

63 Mandibles twisted 60° or more (Fig. 180); metapleuron strongly convex; propodeum posterodorsally very strongly flattened, laterally with a rather sharp crest formed from the vestige of the posterior transverse carina.. 64
– Mandibles twisted 40° or less (Fig. 173); metapleuron weakly to moderately convex; propodeum generally weakly flattened dorsally, if deplanate then laterally without a sharp crest formed from vestige of posterior transverse carina 65

64 Large species, fore wing length 19+ mm; female with ovipositor sheath exceptionally stout (Fig. 111); gaster pale with tergites 5+ infuscate......................... ***stevensi*** sp. n. (p. 210)
– Smaller species, fore wing length 14–16 mm; female with ovipositor sheath relatively slender (Fig. 110); gaster orange with tergites 3+ blackish.................. ***pamelae*** sp. n. (p. 211)

65 Fore wing with *Rs+2r* very straight; fenestra small; distal sclerite absent or extremely weak, represented only by slight infumation (Fig. 275)....... ***randalli*** sp. n. (few specimens) (p. 196)
– Fore wing with *Rs+2r* slightly sinuous; fenestra of moderate size; distal sclerite present but often weak (Figs 276, 277) 66

66 Metapleuron striate (cf. Fig. 178); fore wing with abscissa of *1m-cu* distal to bulla more than 1.10 times as long as *3rs-m*; proximal sclerite gradually tapered distally so that the junction between it and the distal sclerite is not clear (Fig. 276); distal sclerite evanescent distally, not bordering entire fenestra .... ***vilmari*** sp. n. (p. 212)
– Metapleuron more or less punctate (cf. Fig. 177); fore wing with abscissa of *1m-cu* distal to bulla less than 1.00 times as long as *3rs-m*; proximal sclerite abruptly tapered distally, confluent with the slender distal sclerite, but with junction between then clearly recognizable (Fig. 277); distal sclerite more or less complete, extending around most of periphery of fenestra.
.... ***estradarum*** sp. n. (p. 213)



Figs 165–170 *Enicospilus* species. 165, 166, metapleuron and propodeum, lateral view; (165) *E. umanai*; (166) *E. tenuigena*. 167, 168, *E. tenuigena*; (167) subgenital plate of male; (168) mandible. 169, 170, metapleuron and propodeum, lateral; (169) *E. doylei*; (170) *E. purgatus*.

67 Central sclerite crescentic, positioned very close to and of similar surface area to the distal sclerite (Fig. 278). ... ***cubensis*** (Norton) (in part) (p.183)
– Central sclerite of various shapes, if crescentic never both close to and of similar surface area with proximal sclerite ... 68

68 Interocellar area uniformly black ... 69
– Interocellar area yellowish to brownish, at most infuscate between hind ocelli ... 84

69 Clypeus in profile nasute, strongly produced and with a flattened ventral region (Fig. 116); mandibles weakly tapered, with lower tooth slightly the longer. ... ***teodorae*** sp. n. (p. 214)
– Clypeus in profile flat to moderately convex, never nasute, and never with a flattened ventral region; mandibles usually moderately to strongly tapered, generally with upper tooth the longer ... 70

70 Fore wing with *3rs-m* at least 0.75 times as long as abscissa of *M* between *2m-cu* and *3rs-m* (Figs 280–282); stout species, gaster with tergite 2 in profile generally less than 4 times as long as posteriorly deep (Fig. 112) ... 71
– Fore wing with *3rs-m* less than 0.70 times as long as abscissa of *M* between *2m-cu* and *3rs-m* (Figs 283–290); slender species, gaster with tergite 2 in profile more than 4 times as long as posteriorly deep (Fig. 113) ... 73

71 Flagellum stout, 20th segment 1.4–1.6 times as long as broad; tarsal claws of female with pectinae centrally widely interspaced, proximally and distally close together (Fig. 216); very large species, fore wing length 20–23 mm; mesoscutum uniformly reddish brown, or rarely infuscate anteromedially ... ***maritzai*** sp. n. (p. 215)
– Flagellum less stout, 20th segment 1.9–2.2 times as long as broad; tarsal claws of female quite uniformly pectinate (Fig. 218); moderately large species, fore wing length 13–15 mm; mesoscutum usually with black vittae or extensively dark-marked ... 72

72 Fore wing with alar sclerites very weak; *3rs-m* equal to or longer than abscissa of *M* between *3rs-m* and *2m-cu* (Fig. 281) tergite 4 of gaster anterolaterally pale-marked ***exoticus*** (Morley) (in part) (p. 216)
– Fore wing with alar sclerites strongly pigmented; *3rs-m* equal to or shorter than abscissa of *M* between *3rs-m* and *2m-cu* (Fig. 282); tergite 4 of gaster usually entirely black, rarely pale-marked ... ***jesicae*** sp. n. (in part) (p. 218)

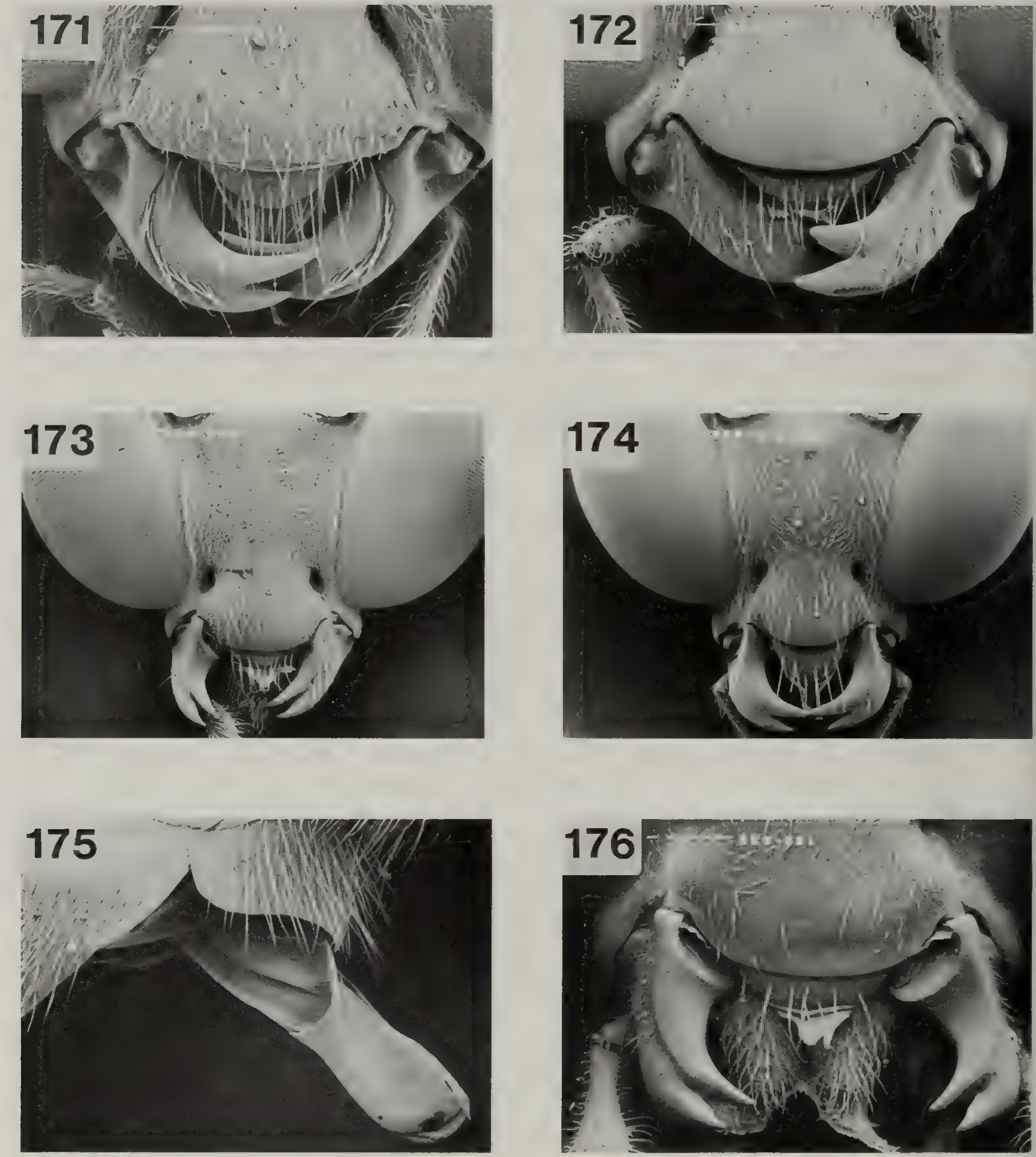
73 Fore wing with distal sclerite strongly pigmented, complete, extending from proximal sclerite around margin of fenestra to nearly reach *Rs+2r* (Figs 283–285) ... 74
– Fore wing with distal sclerite absent, or weakly pigmented, or if strongly pigmented then not bordering virtually the entire margin of the fenestra (Figs 286–290) ... 76

74 Mandibles twisted 30–50°, with lower tooth broad, with a pronounced convex ventral cutting surface (Fig. 120); head, in dorsal view moderately narrow (Fig. 130). ***corcovadoi*** sp. n. (p. 220)
– Mandibles twisted 70° or more, with lower tooth a little compressed but without a ventral cutting edge (Fig. 119); head, in dorsal view strongly transverse (Fig. 131) ... 75

75 Fore wing with central sclerite oval/elliptical (Fig. 284); upper hind part of mesopleuron with a blackish mark; metapleuron finely punctate (Fig. 181) ... ***lovejoyi*** sp. n. (p. 221)
– Fore wing with central sclerite somewhat stoutly S-shaped (Fig. 285); upper hind part of mesopleuron not black-marked; metapleuron striate or rugose-vermiculate (Fig. 182). ***hacha*** sp. n. (p. 223)

76 Meso- and metapleuron highly polished, smooth, at most with fine, sparse punctures (Fig. 183); proximal sclerite abruptly tapered distally, with a very slender confluent distal sclerite (Figs 286, 287) ... 77
– Meso and/or metapleuron striate or variously coarsely sculptured (Fig. 184), sometimes closely punctate, but then the punctures separated by about their own diameters or less; *if* distal sclerite is confluent with the proximal sclerite then the latter is evenly tapered to join the former (Figs 288–290) ... 78

77 Mandibles twisted 70° or more (Fig. 118); occipital carina joining hypostomal carina (Fig. 114); hind trochantellus, in dorsal view, projecting beyond apex of trochanter by about 0.2 of its breadth (Fig. 122); posterior transverse carina of mesosternum complete. ***xanthostigma*** (Szépligeti) (p. 225)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Figs 171–176 *Enicospilus* species. 171, 172, mandibles; (171) *E. purgatus*; (172) *E. columbianus*. 173, 174, face; (173) *E. randalli*; (174) *E. trilineatus*. 175, aedeagus, *E. trilineatus*. 176, mandibles, *E. laurenae*.

– Mandibles twisted 30° or less (Fig. 117); occipital carina ventrally evanescent, not joining hypostomal carina (Fig. 115); hind trochantellus, in dorsal view, projecting beyond apex of trochanter by about 0.5 of its breadth (Fig. 121); posterior transverse carina of mesosternum incomplete .... ***cepillo*** sp. n. (p. 226)

78 Fore wing with central sclerite very slender and characteristically shaped like an inverted letter J (Fig. 288) .... ***persimilis*** (Szépligeti) (p. 227)
– Fore wing with central sclerite various, usually elliptical, subcircular or linear, never J-shaped (Figs 289–296) 79

79 Antenna with at least the five basal flagellar segments yellowish brown or orange 80
– Antenna with five basal flagellar segments blackish or dark brown 81

80 Central sclerite subcircular to oval, its longest axis at 90° to *Rs+2r* (Fig. 289); marginal cell proximally less densely hirsute than centrally; outer surface of mandible without a distinct proximal concavity; gaster usually with tergites 5+ black, the preceding ones yellowish brown .... ***fernaldi*** Hooker (p. 228)
– Central sclerite oval-elliptical, its longest axis almost parallel to fore margin of wing (Fig. 290); marginal cell uniformly hirsute; outer surface of mandible with a well- developed proximal concavity; gaster usually uniformly yellowish brown, rarely with tergites 4+ infuscate.
flavus (Fabricius) (in part) (p. 230)

81 Pterostigma in dorsal view centrally black; distal sclerite absent (Figs 291–293) and lower corner of epicnemial carina abruptly angled, slightly raised (Fig. 186).
A reddish species with gaster with at least tergites 3+ black; central sclerite varying in form from circular to I-shaped, see Figs 291–293 .... ***monticola*** (Cameron) (in part) (p. 233)
– Pterostigma in dorsal view brownish or orange; either with distal sclerite present, or if absent then with lower corner of epicnemial carina evenly rounded and not prominent (Fig. 185). 82

82 Mandibles twisted 70° or more (Fig. 187); fore wing with *Rs+2r* almost straight, incrassate near proximal 0.3 (Fig. 294); marginal cell broadly glabrous proximally. ***madrigalae*** sp. n. (p. 236)
– Mandibles twisted 45° or less (Fig. 188); fore wing with *Rs+2r* slightly sinuous, with proximal 0.3–0.5 slightly broadened (Figs 295, 296); marginal cell proximally usually evenly hirsute, at most narrowly glabrous 83

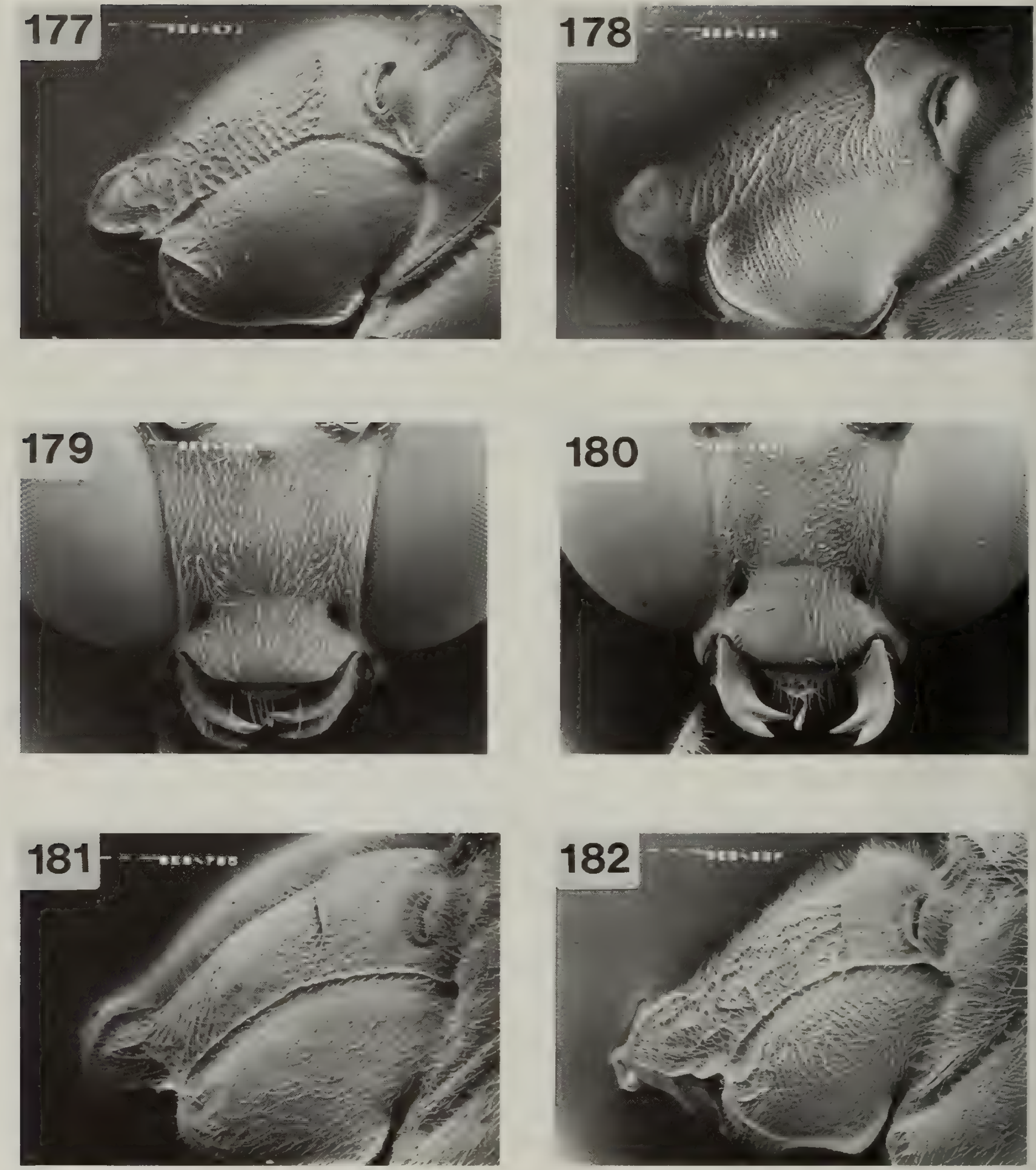
83 Fore wing with central sclerite elongately oval, characteristically with longest axis subtending an angle of 45–70° to *Rs+2r*; *cu-a* proximal to base of *Rs&M* by 0.2 or more times its own length (Fig. 295); mesopleuron almost always with a band of quite coarse rugose-striate sculpture extending from lower proximal corner to near centre (Fig. 189)
xanthocarpus (Szépligeti) (p. 237)
– Fore wing with central sclerite strongly pigmented, broadly oval to subcircular; fore wing with *cu-a* more or less opposite base of *Rs&M* (Fig. 296); mesopleuron ventrally punctate, at most with fine, indistinct wrinkling (Fig. 190) .... ***duckworthi*** sp. n. (p. 238)

84 Fore wing with fenestra bearing 2 separate central sclerites (Fig. 297) .... ***devriesi*** sp. n. (p. 239)
– Fore wing with fenestra bearing 1 central sclerite 85

85 Fore wing with fenestra partially obliterated by an area of fine hairs which extends beyond the distal sclerite, and almost reaches the central sclerite (Fig. 298) .... ***donahuei*** sp. n. (p. 242)
– Fore wing with fenestra glabrous, without an area of pubescence between the distal and central sclerites (Figs 299–352) 86

86 Mandible barely narrowed, but twisted about 80°, subequally bidentate, and with teeth strongly compressed (Fig. 192).
Large species, fore wing length 19–26 mm; *3rs-m* 0.80 or more times as long as abscissa of *M* between *2m-cu* and *3rs-m* .... ***simoni*** sp. n. (p. 243)
– Mandible weakly to very strongly narrowed, variously twisted, usually with upper tooth distinctly the longer, and generally without both teeth compressed, never exactly as above... 87

87 Mandibles quite short, very stout, strongly narrowed and twisted outwards so that upper tooth is forwards; upper mandibular tooth more than 2 times length of the lower tooth (Fig. 191).
Central sclerite large, obovate, weakly sclerotized (Fig. 300) .... ***orosii*** sp. n. (p. 246)
– Mandibles moderately to very long, usually evenly narrowed, twisted so that lower tooth is forwards; upper mandibular tooth less than 2 times length of the lower tooth 88



Figs 177–182 *Enicospilus* species. 177, 178, metapleuron and propodeum, lateral view; (177) *E. laurenae*; (178) *E. vegai*. 179, 180, face; (179) *E. karrensis*; (180) *E. stevensi*. 181, 182, metapleuron and propodeum, lateral view; (181) *E. lovejoyi*; (182) *E. hacha*.

88 Clypeus medioapically produced and slightly out-curved so its apical margin is more or less U-shaped in front view (Fig. 193); epicnemial carina laterally not reaching onto mesopleuron (Fig. 194) .... ***bima*** sp. n. (p. 247)

– Clypeus not medioapically produced, in front view weakly arcuate (Fig. 215); epicnemial carina present on mesopleuron laterally 89

89 Proximal part of antenna (at least dorsally) black 90

– Proximal part of antenna dark brown, orange or yellow.. 114

90 Fore wing with *Rs+2r* strongly sinuous, so that in part its anterior margin is almost parallel to fore margin of wing; central sclerite positioned in anterodistal corner of fenestra (Fig. 302). ***barbarae*** sp. n. (p. 248)

– Fore wing with *Rs+2r* weakly sinuous, its anterior margin evenly convergent to fore margin of wing; central sclerite subcentral or positioned mediodistally (Figs 303–306).............. 91

91 Fore wing with a band of hair along anterior margin of the fenestra, below *Rs+2r* (Fig. 303). Proximal sclerite elongately oval, often weakly sclerotized; 1st subdiscal cell very narrow. ***fosteri*** sp. n. (p. 249)

– Fore wing without a band of hair along anterior margin of fenestra, below *Rs+2r* (Figs 304–306) 92

92 Propodeum long, with posterior area almost smooth, at most with only vestigial rugae (Fig. 195).

Scutellum with lateral carinae present only anteriorly; central sclerite obovate; fore wing with first abscissa of *Cu*1a less than 1.05 times as long as first abscissa of *Cu*1 (Fig. 304) .... ***cornifuscus*** nom. n. (p. 250)

– Propodeum shorter, with posterior area strongly sculptured, with distinct rugae............ 93

93 Posterior transverse carina of mesosternum broadly incomplete centrally, the gap between the two ends at least as wide as thickness of hind trochantellus 94

– Posterior transverse carina of mesosternum more or less complete, at most only narrowly effaced on median line 96

94 Scutellum rounded, with lateral longitudinal carinae only discernible as an anterior vestige (Fig. 198); mandible twisted 40° or more, with lower tooth swollen and with a sharp, convex ventral edge (Fig. 199).. ***kelloggae*** sp. n. (in part) (p. 259)

– Scutellum slightly flattened centrally, with distinct lateral longitudinal carinae extending more than 0.6 of its length (as in Fig. 215); mandible twisted 20° or less, with lower tooth neither noticeably swollen nor with a sharp, convex ventral edge 95

95 Fore wing with *3rs-m* short, about 0.35 times as long as the abscissa of *M* between *3rs-m* and *2m-cu* (Fig. 305); lower face broad, 0.83 times as broad as long; anterior transverse carina of propodeum complete.. ***catemacoi*** sp. n. (p. 251)

– Fore wing with *3rs-m* quite long, 0.75 times the length of abscissa of *M* between *3rs-m* and *2m-cu* (Fig. 306); lower face quite narrow, 0.74 times as long as broad; anterior transverse carina of propodeum broadly incomplete.................................. ***gabrieli*** sp. n. (p. 252)

96 Upper surface of fore wing with distal abscissa of 1*A* bearing a row of long, and very fine hairs (Figs 307, 308). .... ***luisi*** sp. n. (p. 253)

– Upper surface of fore wing with distal abscissa of 1*A* glabrous, without long fine hairs (Figs 309–314) 97

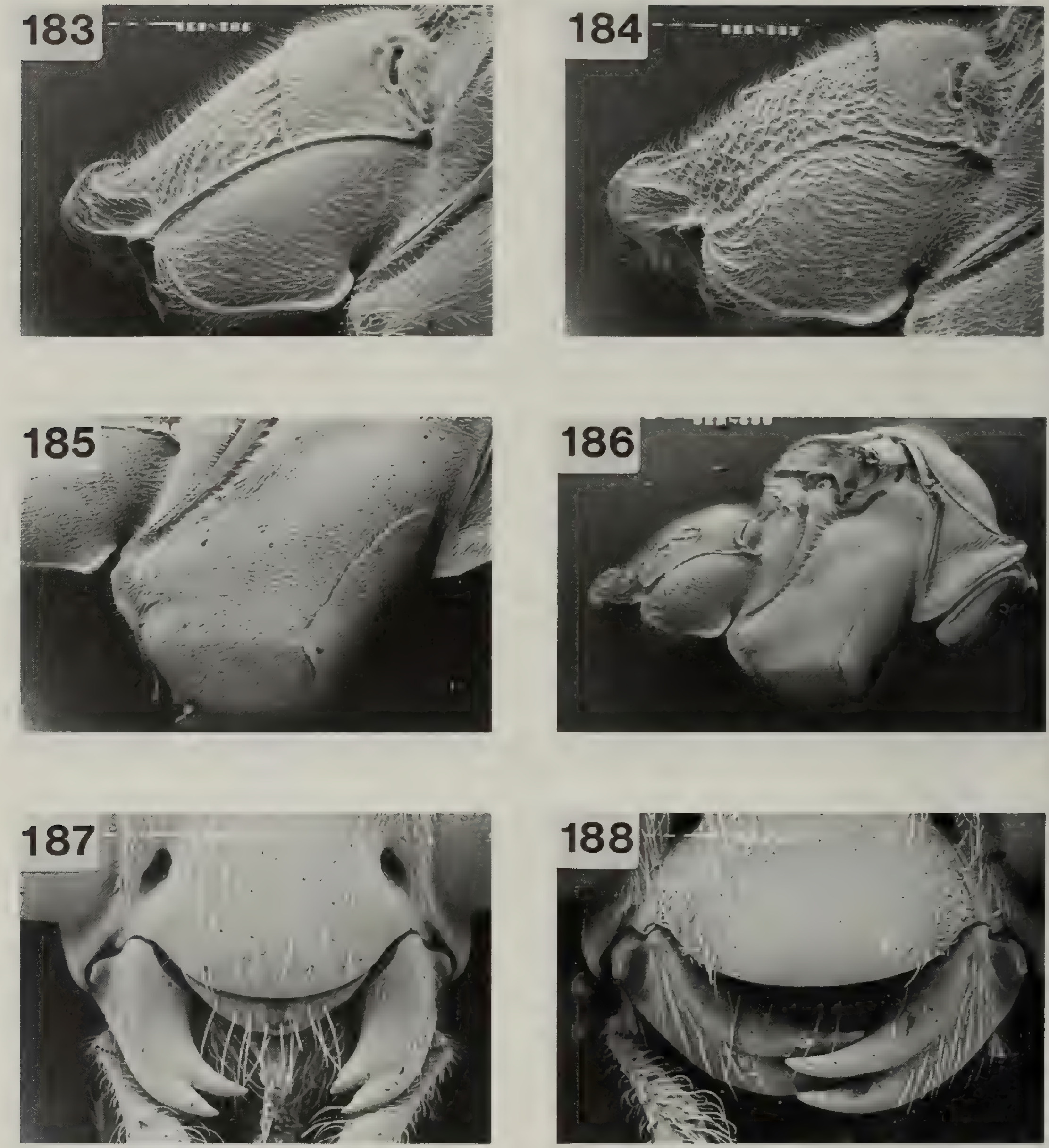
97 Fore wing with anterior corner of discosubmarginal cell with a cluster of hairs on membrane near base of *Rs+2r*, sometimes with this area of hairs separated by a glabrous band from rest of cell (cf. Fig. 307).

Central sclerite small and slender, similar to that of preceding species (Fig. 307) ***opleri*** sp. n. (p. 254)

– Fore wing with anterior corner of discosubmarginal cell glabrous, this glabrous area confluent with fenestra (Figs 310–314) *or*, if hairs are apparently present, then they actually arise from vein, not membrane (Fig. 309) 98

98 Scutellum with lateral carinae present only on anterior half *and* posterior transverse carina of mesosternum centrally produced forward so entire carina has the form of a chevron (Fig. 132).

Fore wing with central sclerite very small and indistinctly delineated (Fig. 309). ***guindoni*** sp. n. (p. 256)



Figs 183–188 *Enicospilus* species. 183, 184, metapleuron and propodeum, lateral view; (183) *E. xanthostigma*; (184) *E. fernaldi*. 185, mesopleuron, *E. duckworthi*. 186, alitrunk, lateral view, *E. monticola*. 187, 188, mandibles; (187) *E. madrigalae*; (188) *E. xanthocarpus*.

– Scutellum usually with lateral carinae extending 0.7 or more of its length, *or* if with these carinae very short, then posterior transverse carina of mesosternum straight (or rarely incomplete centrally); posterior transverse carina of mesosternum otherwise various, usually not produced forward centrally (Fig. 133) 9

99 Fore wing with central sclerite very slender, more or less I- shaped, with longest axis perpendicular to axis of vein *Rs+2r* (Figs 310, 311) 100

– Fore wing with central sclerite from narrowly comma-shaped, to subcircular or irregularly oval, if slender then with longest axis subparallel to *Rs+2r* (Figs 312–322) 101

100 Mandibles strongly narrowed, twisted about 70°; fore wing with distal sclerite absent; marginal cell proximally uniformly hirsute (Fig. 310); mesoscutum unicolorous reddish brown; pterostigma black.

Metapleuron strongly striate .... **monticola** (Cameron) (in part) (p. 233)

– Mandibles evenly tapered, twisted about 45° or less; fore wing with distal sclerite discernible; marginal cell proximally glabrous or notably more sparsely hirsute than it is centrally (Fig. 311); mesoscutum with three longitudinal black marks; pterostigma brownish yellow.

leoni sp. n. (p. 257)

101 Fore wing with abscissa of *Cu*1 between 1*m-cu* and *Cu*1a more than 0.60 times as long as *Cu*1b (Fig. 339).

Central sclerite large, distinctly delineated; distal sclerite complete, confluent with proximal sclerite. .... **masoni** sp. n. (in part) (p. 292)

– Fore wing with abscissa of *Cu*1 between 1*m-cu* and *Cu*1a less than 0.50 times as long as *Cu*1b (Figs 312–325) 102

102 Lower tooth of mandible swollen, very much stouter than the upper and ventrally with a convex margin (Fig. 199).

Metapleuron usually smooth and punctate; distal sclerite discernible (Fig. 312).

kelloggae sp. n. (in part) (p. 259)

– Lower tooth of mandible not swollen, of similar stoutness to the upper one, or if slightly broader, then never with ventral margin convex 103

103 Propodeum with posterior area weakly sculptured, laterally almost coriaceous, and with a single median longitudinal ridge; frons with a black mark extending from median ocellus to between bases of antennae .... **mengoi** sp. n. (p. 260)

– Propodeum coarsely rugose, often with rugae posteriorly concentrically striate, or if weaker then always with at least 3 longitudinal ridges centrally; frons generally unicolorous yellowish 104

104 Distal sclerite strong, separated from proximal sclerite; proximal sclerite characteristically hastate (Fig. 313). .... **haberi** sp. n. (p. 261)

– Distal sclerite absent or weak, or if quite strongly sclerotized then it is confluent with the proximal sclerite; proximal sclerite variously triangular, not hastate (Figs 315–325) 105

105 Flagellum with central segments exceptionally elongate, 2.6- 2.8 times as long as broad.

Meso- and metapleurae regularly punctate, though rarely the latter may have isolated rugae dorsally; lateral longitudinal carina of propodeum complete; fore wing with central sclerite variously comma-shaped (Figs 316–318); male with lateromedian rows of close erect hairs on sternite 7 and anterior margin of sternite 8, rest of sternite 8 glabrous (Fig. 200).

lacsa sp. n. (in part) (p. 262)

– Flagellum with central segments normally long, 2.4 or less times as long as broad 106

106 Central sclerite subtriangular, with distal side acutely angled and distal sclerite absent (Fig. 319); male with lateromedian rows of close erect hairs on sternite 7 and anterior margin of sternite 8, rest of sternite 8 glabrous, sternite 9 with fine decumbent pubescence (cf. Fig. 200).

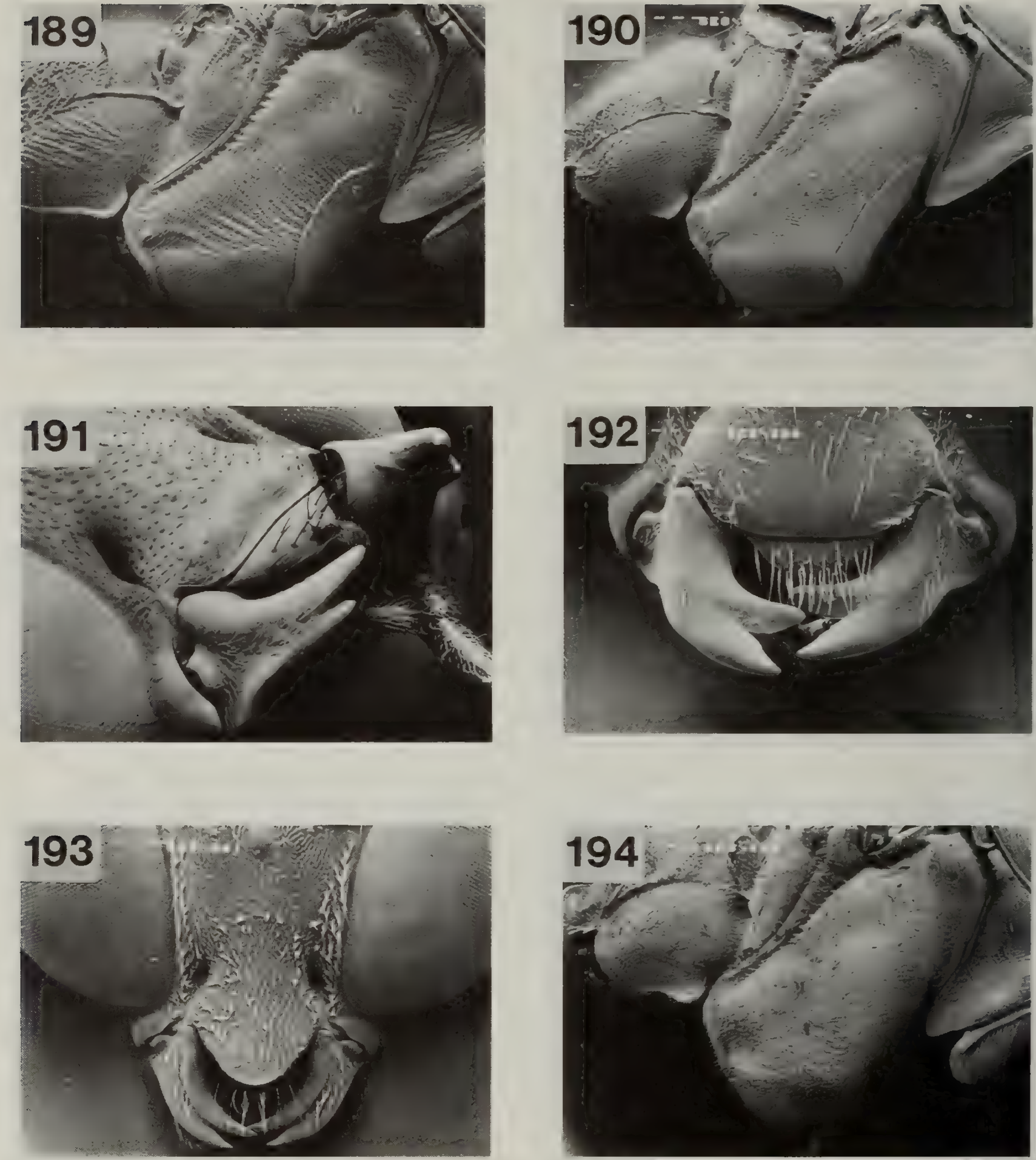
echeverri sp. n. (in part) (p. 300)

– Central sclerite generally oval to D-shaped, rarely crescentic, or if very rarely subtriangular then with distal sclerite distinct; distal sclerite otherwise present or absent (Figs 320–325); male with long stout erect hairs on sternites 7–9 107

107 Central sclerite narrowly crescentic (Fig. 315).

Metapleuron regularly punctate (Fig. 135) .... **brenesiae** sp. n. (p. 265)

– Central sclerite usually either oval or D-shaped, or very rarely subtriangular, never crescent-shaped (Figs 320–325) 108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Figs 189–194 *Enicospilus* species. 189, 190, mesopleuron; (189) *E. xanthocarpus*; (190) *E. duckworthi*. 191, 192, mandibles; (191) *E. orosii*; (192) *E. simoni*. 193, 194, *E. bima*; (193) face; (194) mesopleuron.

108 Mesoscutum more or less uniformly reddish brown; alitrunk and tergites 1–2 of gaster reddish brown, tergites 3+ black ... 109

– Mesoscutum almost always with dark brown or black longitudinal vittae which are separated by pale yellowish brown lines; alitrunk and much of gaster brownish yellow to dirty yellowish brown, at most with posterior tergites weakly infuscate, sometimes with distal most blackish 110

109 Dorsal surface of posterior part of propodeum concentrically striate (Fig. 201); metapleuron weakly rugulose-punctate posterodorsally (Fig. 202); distal sclerite more or less absent (Fig. 320) ... ***forsythei*** sp. n. (p. 265)

– Dorsal surface of posterior part of propodeum rugose (Fig. 203); metapleuron posterodorsally coarsely rugose (Fig. 204); distal sclerite complete (Fig. 321) .... ***fogdenorum*** sp. n. (p. 266)

110 Fore wing with *3rs-m* less than 0.50 times as long as abscissa of *M* between *2m-cu* and *3rs-m* (Fig. 322); smaller species, fore wing length less than 16 mm ... ***burgosi*** sp. n. (in part) (p. 267)

– Fore wing with *3rs-m* more than 0.52 times as long as abscissa of *M* between *2m-cu* and *3rs-m* (Figs 323–325); large species, fore wing length 17+ mm ... 111

111 Mandible apically strongly twisted through 50° or more; propodeum with posterior transverse carina represented laterally by a distinct raised crest (Fig. 134) ... 112

– Mandible apically weakly twisted, turned through 45° or less (Fig. 208); propodeum without any trace of a crest formed from a vestige of the posterior transverse carina ... 113

112 Mandible with a distinct ridge extending from the upper proximal corner to base of upper tooth (Figs 136, 217); gaster slender, tergite 2 in profile more than 5 times as long as posteriorly deep ... ***erasi*** sp. n. (p. 269)

– Mandible without a ridge extending from the upper proximal corner to the base of the upper tooth; gaster moderately stout, tergite 2 in profile 4 or less times as long as posteriorly deep. ***jesicae*** sp. n. (in part) (p. 218)

113 Fore wing with *Rs+2r* virtually straight (Fig. 324); marginal cell proximally rather sparsely hirsute; gaster slender, tergite 2 more than 6.0 times as long as posteriorly deep; propodeum posterodorsally irregularly rugose ... ***galilea*** sp. n. (p. 270)

– Fore wing with *Rs+2r* distinctly bowed centrally (Fig. 325); marginal cell proximally almost evenly hirsute; gaster quite stout, tergite 2 in profile less than 5.0 times as long as posteriorly deep; propodeum dorsally with striae subconcentric posterolaterally, usually extended forward in midline (Fig. 207) ... ***hubbelli*** sp. n. (p. 271)

114 Fore wing with central sclerite elongately linear, positioned in centre of fenestra, and with longest axis parallel to *Rs+2r* (Fig. 326).
Alitrunk laterally polished and rather weakly sculptured; an extremely common and widespread species. ... ***flavoscutellatus*** (Brullé) (p. 272)

– Fore wing with central sclerite subcircular, oval or crescent-shaped, or if linear, then with longest axis perpendicular to *Rs+2r* (Figs 327–330) ... 115

115 Mandibles short, twisted 70° or more ... 116

– Mandibles moderately long to long, twisted 10–60° ... 120

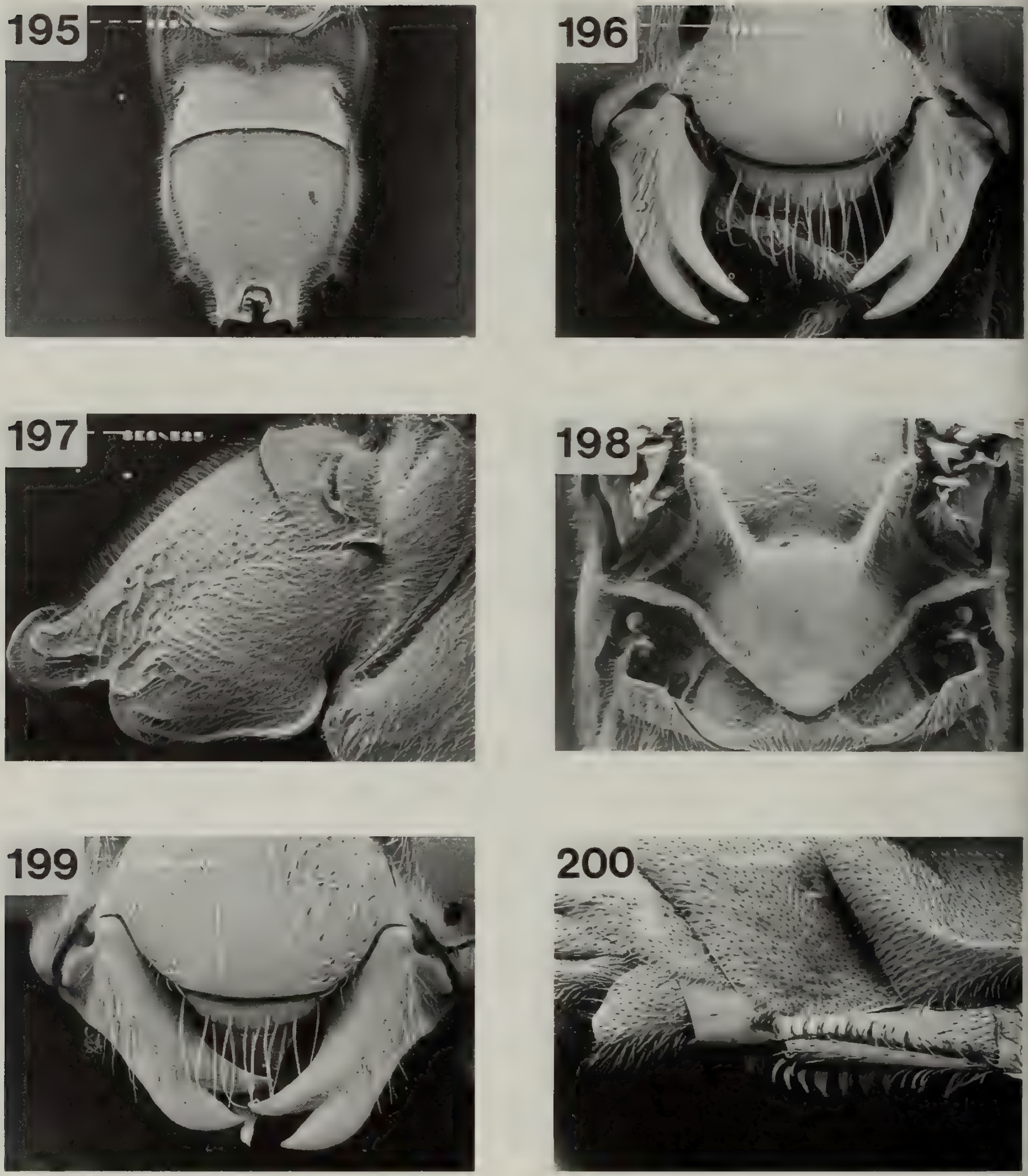
116 Fore wing with proximal corner of marginal cell uniformly hirsute; anterior part of discosubmarginal cell hirsute between proximal sclerite and anterior corner; fenestra very long, its distal end reaching nearly to base of *Rs* (Fig. 327); a more or less uniformly pale yellow species ... ***woldai*** sp. n. (p. 275)

– Fore wing with proximal corner of marginal cell glabrous or rather sparsely hirsute; anterior part of discosubmarginal cell with few or no hairs between proximal sclerite and anterior corner; distal margin of fenestra separated from base of *Rs* by more than length of *M* between *Rs* and *3rs-m* (Figs 328–330); pale yellow, but often with mesoscutum and/or terminal segments of gaster marked with black or dark brown ... 117

117 Posterior transverse carina of mesosternum broadly incomplete centrally or with central portion very indistinct ... 118

– Posterior transverse carina of mesosternum complete, with central part strongly raised 119

118 Proximal sclerite more or less triangular, with proximal side forming an angle (Fig. 328); fore wing with *3rs-m* more than 0.42 times as long as abscissa of *M* between *2m-cu* and *3rs-m*; head posteriorly very short, so that the hind ocelli are separated from occipital carina by less than



Figs 195–200 *Enicospilus* species. 195, propodeum, dorsal view, *E. cornifuscus*. 196, 197, *E. leoni*; (196) mandibles; (197) metapleuron and propodeum, lateral view. 198, 199, *E. kelloggae*; (198) scutellum; (199) mandibles. 200, subgenital plate of male, *E. lacsa*.

their smallest diameter (Fig. 128); propodeum with posterior area finely and weakly coriaceous .... ***liesneri*** sp. n. (p. 276)

– Proximal sclerite more or less quadrate, with proximal side flat (Fig. 329); fore wing with *3rs-m* less than 0.42 times as long as abscissa of *M* between *2m-cu* and *3rs-m*; head posteriorly only moderately short, so that hind ocelli are separated from occipital carina by more than their own smallest diameter (cf. Fig. 129); propodeum with posterior area rugose, reticulate, or concentrically striate .... ***marini*** sp. n. (p. 278)

119 Dark mark on mesopleuron extending ventrally along pleural suture below level of episternal scrobe, then usually broadly across pleuron (Fig. 125); second segment of gaster usually with laterotergite pendant; hind wing with first abscissa of *Rs* weakly bowed (Fig. 127); fore wing generally with distal sclerite either narrowly separated from proximal sclerite or with them joined by a weak bridge (Fig. 330); mesoscutum usually posteriorly infuscate.. ***sanchezi*** sp. n. (p. 279)

– Dark mark on mesopleuron extending from upper corner to episternal scrobe and not extending ventrally along pleural suture (Fig. 124); second segment of gaster with the laterotergite folded under margin of tergite; hind wing with first abscissa of *Rs* more or less straight (Fig. 126); fore wing with distal sclerite confluent with proximal sclerite (Fig. 331); mesoscutum with three dark vittae present anteriorly.......................... ***pescadori*** sp. n. (p. 281)

120 Hind wing with *cu-a* greater than 0.4 times the length of the first abscissa of *Cu*1 which is bowed (Fig. 142); fore wing with *cu-a* subopposite the base of *Rs&M* or proximal to it by its own thickness, and with distal sclerite entirely absent (Figs 332, 333).
Southern Floridan and Caribbean species 121

– Hind wing with *cu-a* less than 0.4 times the length of the first abscissa of *Cu*1 which is generally more or less straight (Figs 141, 143, 144); fore wing *either* with *cu-a* proximal to base of *Rs&M* by 0.1 or more of its length, *or* with distal sclerite present, *or* both 122

121 Fore wing with marginal cell proximally uniformly hirsute; *Rs+2r* not incrassate centrally (Fig. 332); abscissa of *1m-cu* distal to bulla less than 0.90 times as long as *3rs-m*; metapleuron very strongly convex, polished and finely punctate (Figs 145, 211); male with sternites 7–9 bearing scattered, long, fine semidecumbent hairs. .... ***howdenorum*** sp. n. (p. 282)

– Fore wing with marginal cell proximally very sparsely hirsute; *Rs+2r* strongly incrassate centrally (Fig. 333); abscissa of *1m-cu* distal to bulla more than 0.95 times as long as *3rs-m*; metapleuron moderately convex, weakly polished coarsely punctate and generally with diagonal rugae discernible (Fig. 146); male with sternite 7 with lateral longitudinal rows of long close erect hairs, the sternite centrally glabrous; sternite 8 more or less glabrous; sternite 9 bearing short fine decumbent pubescence. .... ***sondrae*** sp. n. (p. 284)

122 Marginal cell of fore wing proximally broadly glabrous, at most with isolated scattered hairs along anterior periphery (Figs 334–336, 352) 123

– Marginal cell of fore wing not broadly glabrous proximally, either uniformly hirsute, or more sparsely hirsute (Figs 337–350), or occasionally with a glabrous area adjacent to *Rs+2r*, but if such an area is present then with a distinct area of hairs extending to corner centrally..... 126
[Intermediate specimens will key either way]

123 Hind wing with only 4 distal hamuli on vein *R*; fore wing with *cu-a* very slightly distal to base of *Rs&M* (Fig. 334); mesopleuron with a large dark mark posteriorly that extends down the pleural suture to the level of the episternal scrobe (Fig. 123)........... ***oduberi*** sp. n. (p. 285)

– Hind wing with 5 or more distal hamuli on vein *R*; fore wing with *cu-a* proximal to base of *Rs&M* (Figs 335,336); mesopleuron with, at most a small dark mark in upper posterior corner ... 124

124 Fore wing with distal sclerite strong, broadly separated from the proximal sclerite (Fig. 335); central sclerite oval; abscissa of *Cu1* between *1m-cu* and *Cu*1a 0.20–0.37 times as long as *Cu*1b; hind trochantellus unusually long, dorsally projecting well beyond apex of trochanter (Fig. 139); small species, fore wing length 9–12 mm.................. ***gallegosi*** sp. n. (p. 286)

– Fore wing with distal sclerite weak or indistinct, when visible confluent with the proximal sclerite (Fig. 336); central sclerite more or less crescentic; abscissa of *Cu1* between *1m-cu* and *Cu*1a more than 0.40 times as long as *Cu*1b; hind trochantellus short, not or barely projecting beyond the apex of the trochanter (Fig. 140); larger species, fore wing length 17+ mm.... 125

125 Propodeum with anterior transverse carina usually centrally incomplete, sometimes absent; metapleuron punctate, more or less evenly convex; gaster never narrowly black dorsally.
dispilus (Szépligeti) (few specimens) (p. 296)

– Propodeum with anterior transverse carina centrally complete, at most only obsolescent at lateral extremities; metapleuron posterodorsally rugose-striate, usually flattened ventrally (Fig. 210); gaster usually narrowly black-marked dorsally .... ***parkeri*** sp. n. (p. 287)

126 Central sclerite small and more or less circular, its maximum diameter subequal to maximum thickness of *Rs+2r* (Fig. 337) *and* with distal sclerite present......... ***ulfstrandi*** sp. n. (p. 288)

– Central sclerite moderately large to large, often oval or crescent-shaped, if subcircular then its diameter much greater than thickness of *Rs+2r* (Figs 338–343) *or*, if subcircular and relatively small, then distal sclerite absent (Fig. 344) 127

127 Fore wing with abscissa of *Cu*1 between 1*m-cu* and *Cu*1a more than 0.55 times as long as *Cu*1b (Figs 338, 339) 128

– Fore wing with abscissa of *Cu*1 between 1*m-cu* and *Cu*1a less than 0.50 times as long as *Cu*1b (Figs 340–352) 129

128 Central sclerite crescent-shaped (Fig. 338); hind wing with first abscissa of *Rs* distinctly bowed (Fig. 144); wings strongly infumate; gaster with tergites 3–7 posteriorly and ventrally dark, centrally pallid so the gaster has a mottled appearance.............. ***georginae*** sp. n. (p. 291)

– Central sclerite elongately D-shaped (Fig. 339); hind wing with first abscissa of *Rs* more or less straight (Fig. 141); wings hyaline; gaster with posterior tergites uniformly infuscate so that it does not appear to be mottled .... ***masoni*** sp. n. (in part) (p. 292)

129 Fore wing with central sclerite rather narrow and comma- shaped (Fig. 340).
Vein *Rs+2r* distinctly sinuous; metapleuron diagonally striate (Fig. 212); upper mandibular tooth slender; distal sclerite usually absent......................... ***kleini*** sp. n. (p. 293)

– Fore wing with central sclerite oval, hastate, circular, D- shaped or sometimes crescentic or very broad and comma- shaped (Figs 341–352).................................... 130

130 Interocellar area distinctly and rather uniformly brownish, darker brown than vertex; central sclerite elliptical; distal sclerite quite long (Fig. 341)....... ***flavus*** (Fabricius) (in part) (p. 230)

– Interocellar area yellowish orange, concolorous with vertex, at most slightly infuscate only between hind ocelli; central sclerite oval, subcircular, subtriangular hastate or crescentic; distal sclerite usually regularly triangular (Figs 342–352) 131

131 Distal sclerite distinct, strongly sclerotized and narrowly separated from proximal sclerite (Fig. 342)... ***hemicrescellae*** sp. n. (p. 294)

– Distal sclerite absent, or if discernible (and it may be quite strongly sclerotized) then it is broadly confluent with the distal sclerite (Figs 343–352) 132

132 Hind trochantellus dorsally 0.2–0.4 times as long as broad (Fig. 138); metapleuron coriaceous-striate (Fig. 205).
Distal sclerite absent (Fig. 343); terminal sternites of male gaster with scattered long erect hairs... ***burgosi*** sp. n. (in part) (p. 267)

– Hind trochantellus dorsally 0.1 or less times as long as broad (Fig. 140); metapleuron punctate, punctostriate or partially rugose (Fig. 213) 133

133 Fore wing with central sclerite subcircular, D-shaped, comma- shaped, or less commonly crescentic (Figs 344, 347–352); male with sternites 7–9 with quite dense long erect pubescence (Fig. 214).. 134

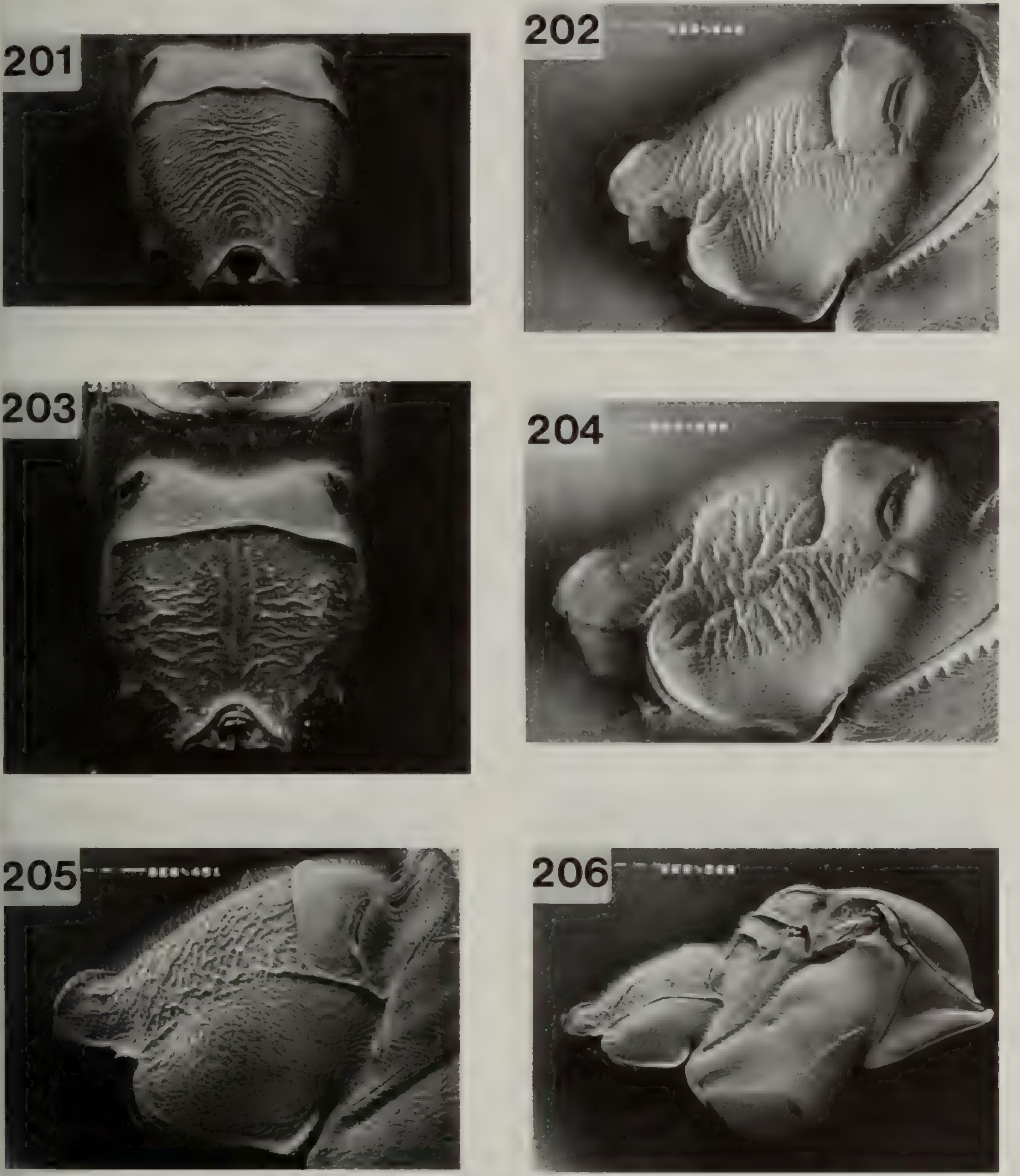
– Fore wing with central sclerite more or less hastate, with inner side concave, and with outer side strongly curved or distally pointed (Figs 345, 346); male with sternite 7 and anterior margin of sternite 8 bearing lateromedian rows of close short hairs, remainder of sternite 8 glabrous; sternite 9 with fine decumbent pubescence (cf. Fig. 200). 135

134 Distal sclerite absent; proximal sclerite hastate; central sclerite subcircular, indistinctly defined (Fig. 344).. ***ceciliae*** sp. n. (p. 295)

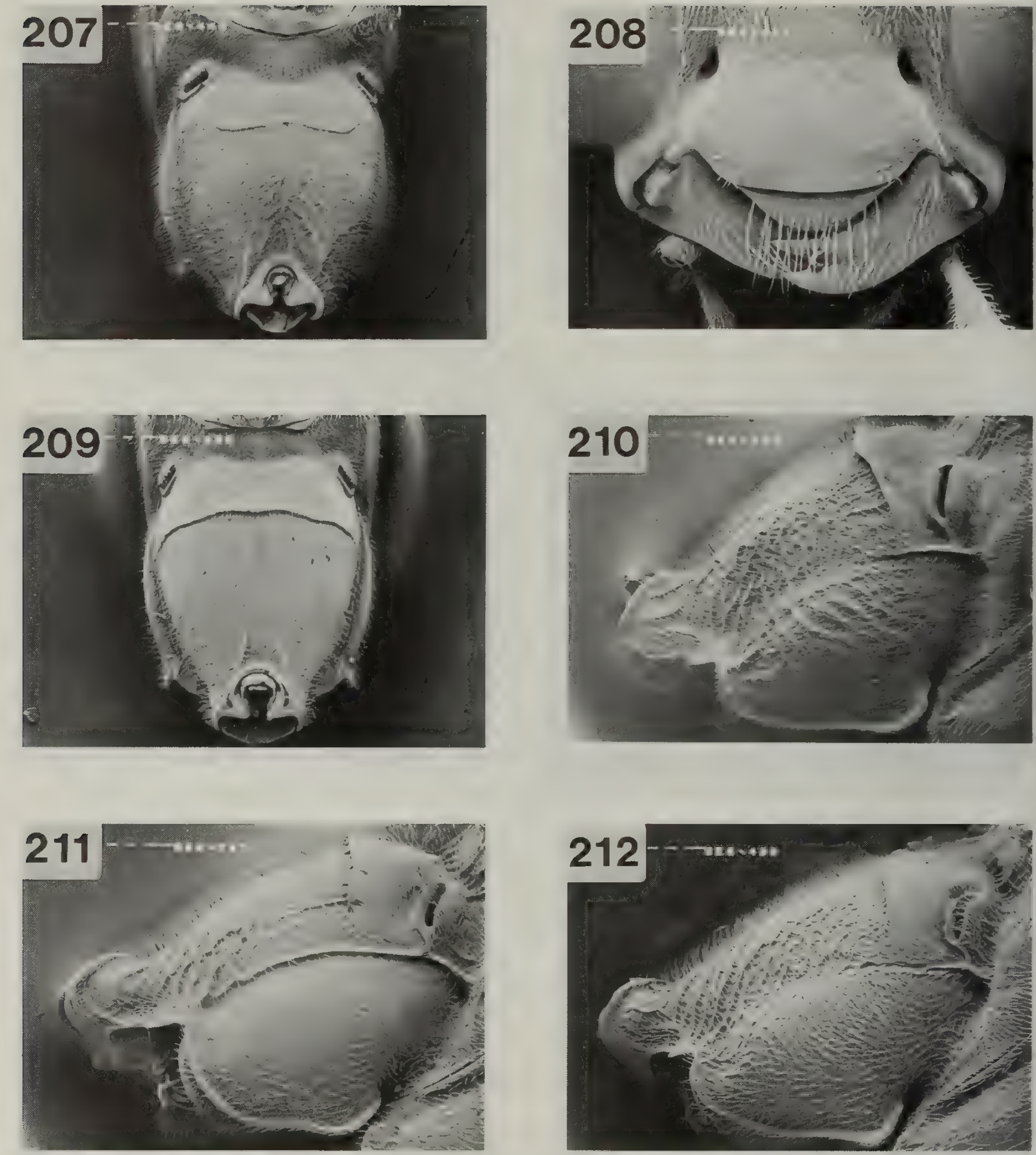
– Distal sclerite present; proximal sclerite simply triangular; central sclerite various, if subcircular then distinctly delineated (Figs 347–352). ...... ***dispilus*** (Szépligeti) (most specimens) (p. 296)

135 Central flagellar segments very slender, 2.5–3.0 times as long as broad; fore wing with central sclerite distally rounded, fenestra of moderate length (Fig. 345); lower face generally less than 0.70 times as broad as long.......................... ***lacsa*** sp. n. (in part) (p. 262)

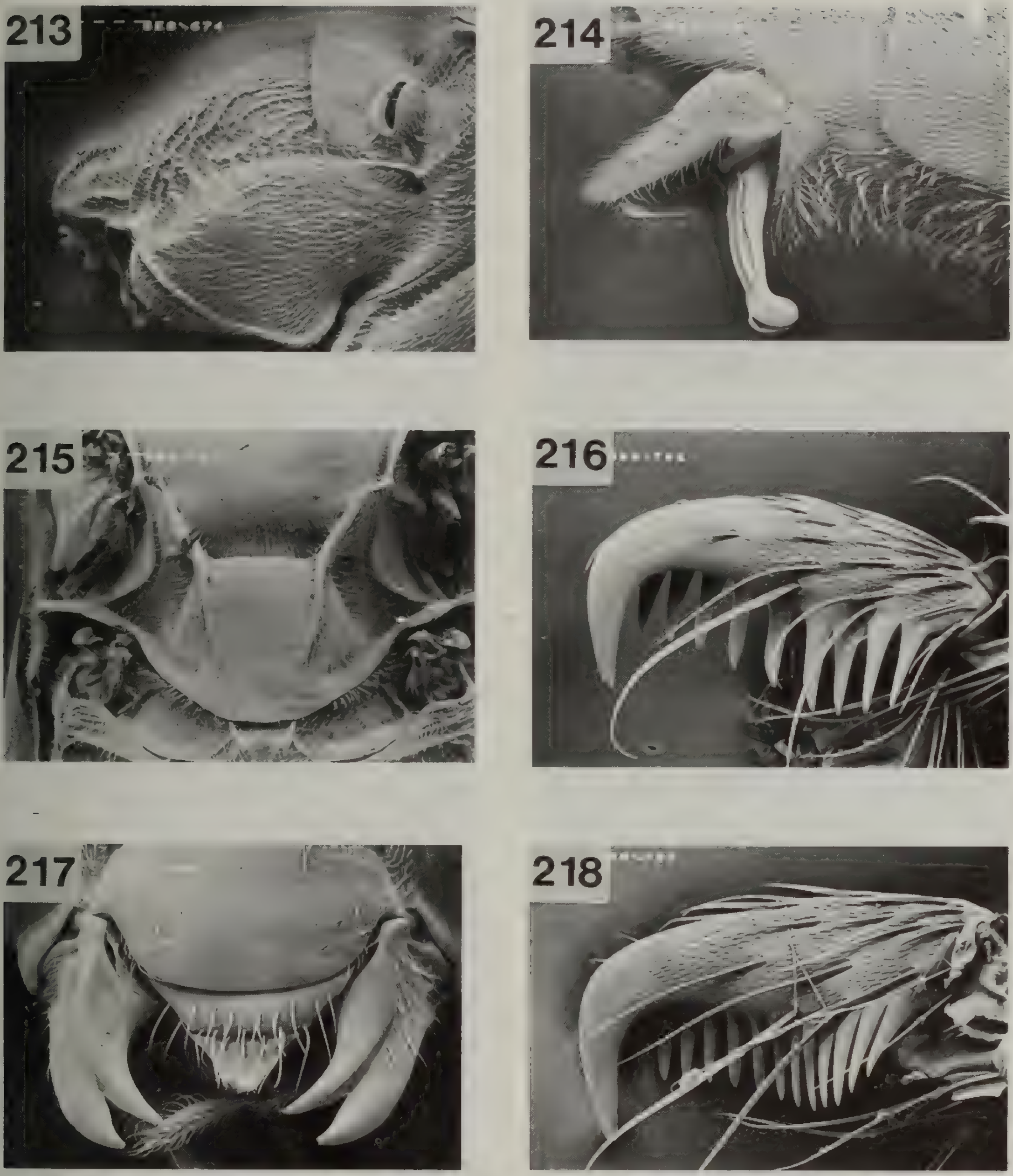
– Central flagellar segments not exceptionally slender, 2.0–2.2 times as long as broad; fore wing with central sclerite distally acutely angled, fenestra unusually long (Fig. 346); lower face generally greater than 0.70 times as broad as long.......... ***echeverri*** sp. n. (in part) (p. 300)



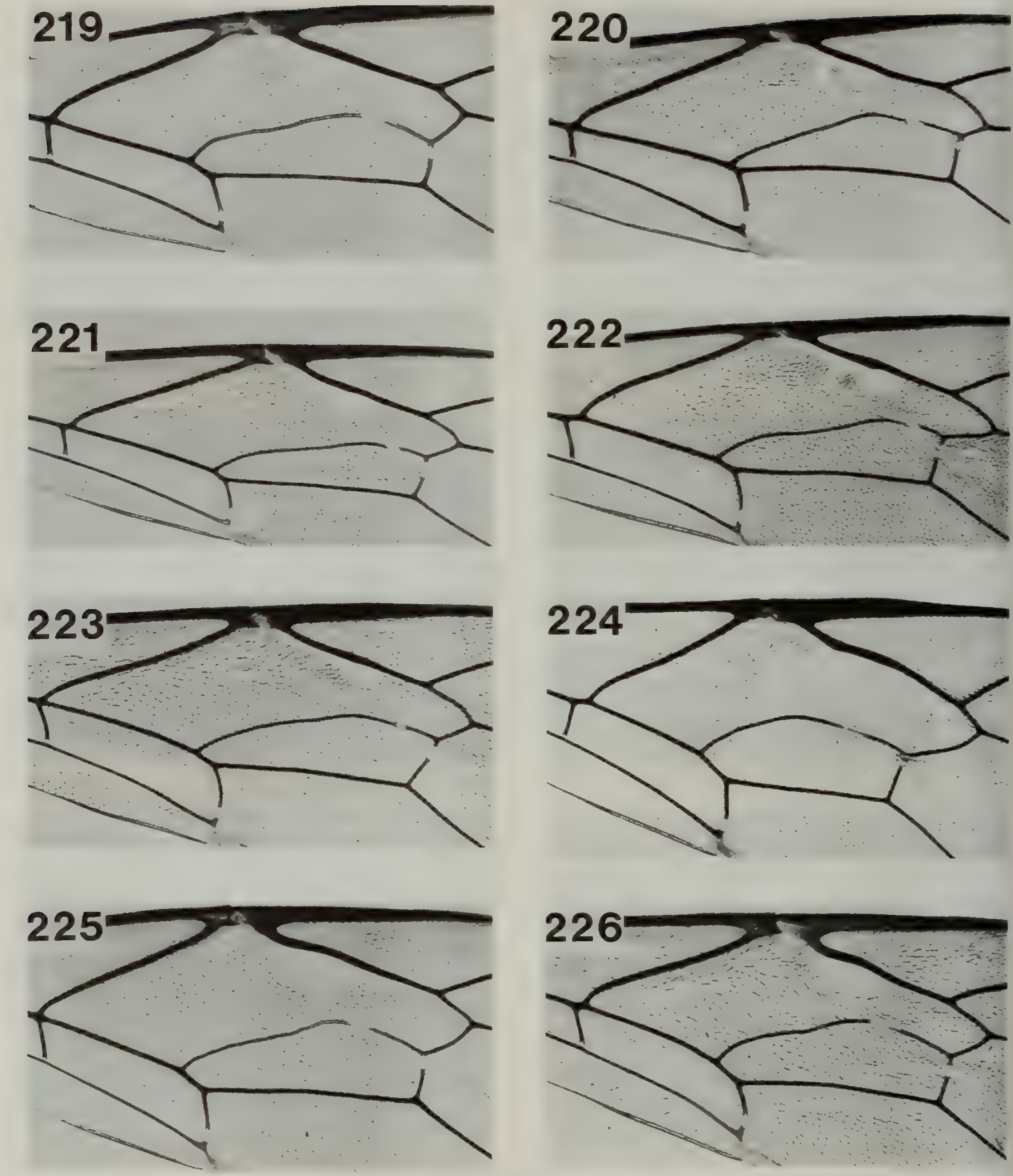
Figs 201–206 *Enicospilus* species. 201, 202, *E. forsythei*; (201) propodeum dorsal; (202) metapleuron and propodeum, lateral view. 203, 204, *E. fogdenorum*; (203) propodeum dorsal; (204) metapleuron and propodeum, lateral view. 205, metapleuron and propodeum, lateral view, *E. burgosi*. 206, alitrunk, lateral view, *E. flavoscutellatus*.



Figs 207–212 *Enicospilus* species. 207, 208, *E. hubbelli*; (207) propodeum dorsal; (208) mandibles. 209, propodeum dorsal, *E. liesneri*. 210–212, metapleuron and propodeum, lateral, view; (210) *E. parkeri*; (211) *E. howdenorum*; (212) *E. kleini*.



Figs 213–218 *Enicospilus* species. 213, 214, *E. dispilus*; (213) metapleuron and propodeum, lateral view; (214) subgenital plate and aedeagus of male. 215, scutellum, *E. flavoscutellatus*. 216, hind tarsal claw of female, *E. maritzai*. 217, mandibles, *E. erasi*. 218, hind tarsal claw of female, *E. exoticus*.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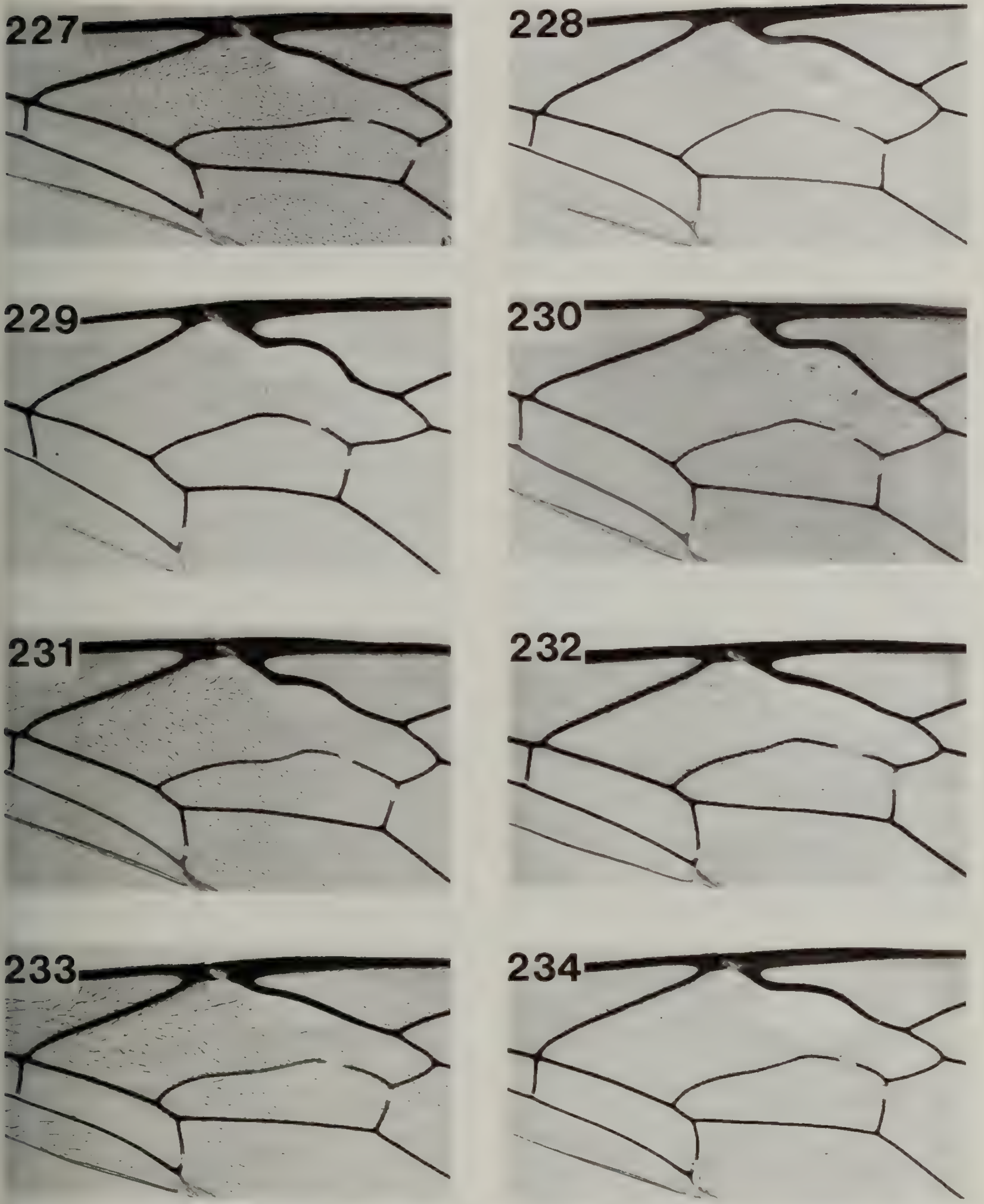
Figs 219–226 *Enicospilus* species, central part of right fore wing in dorsal view; (219) *E. bozai*; (220) *E. enigmus*; (221) *E. exoticus*; (222) *major*; (223) *E. clarkorum*; (224) *E. glabratus*; (225) *E. alvaroi*; (226) *E. chiriquensis*.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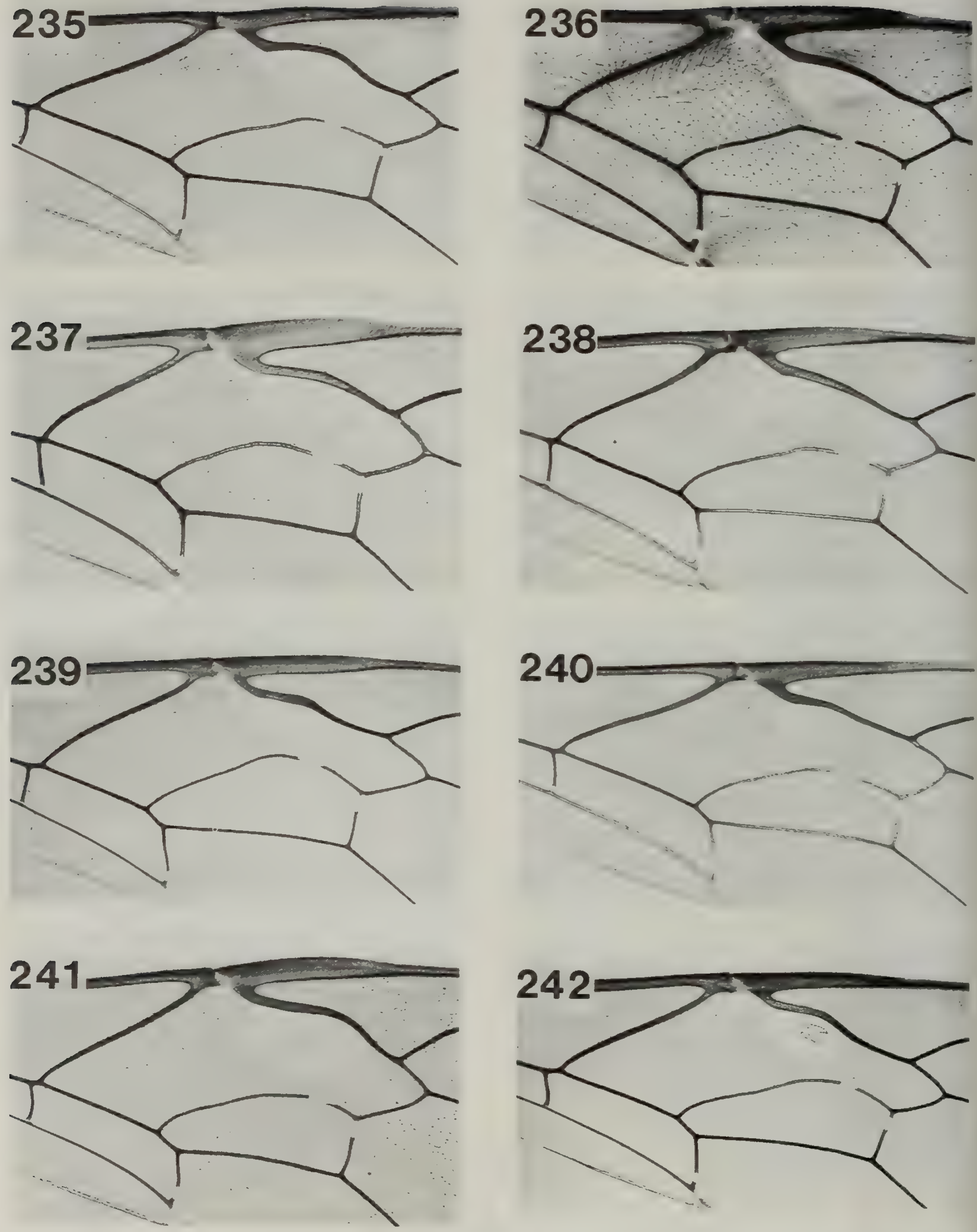
Figs 227–234 *Enicospilus* species, central part of right fore wing in dorsal view; (227) *E. mayi*; (228) *E. robertoi*; (229) *E. brevis*; (230) *E. scuintlei*; (231) *E. mexicanus*; (232) *E. abelardoi*; (233) *E. hallwachsae*; (234) *E. cameronii*.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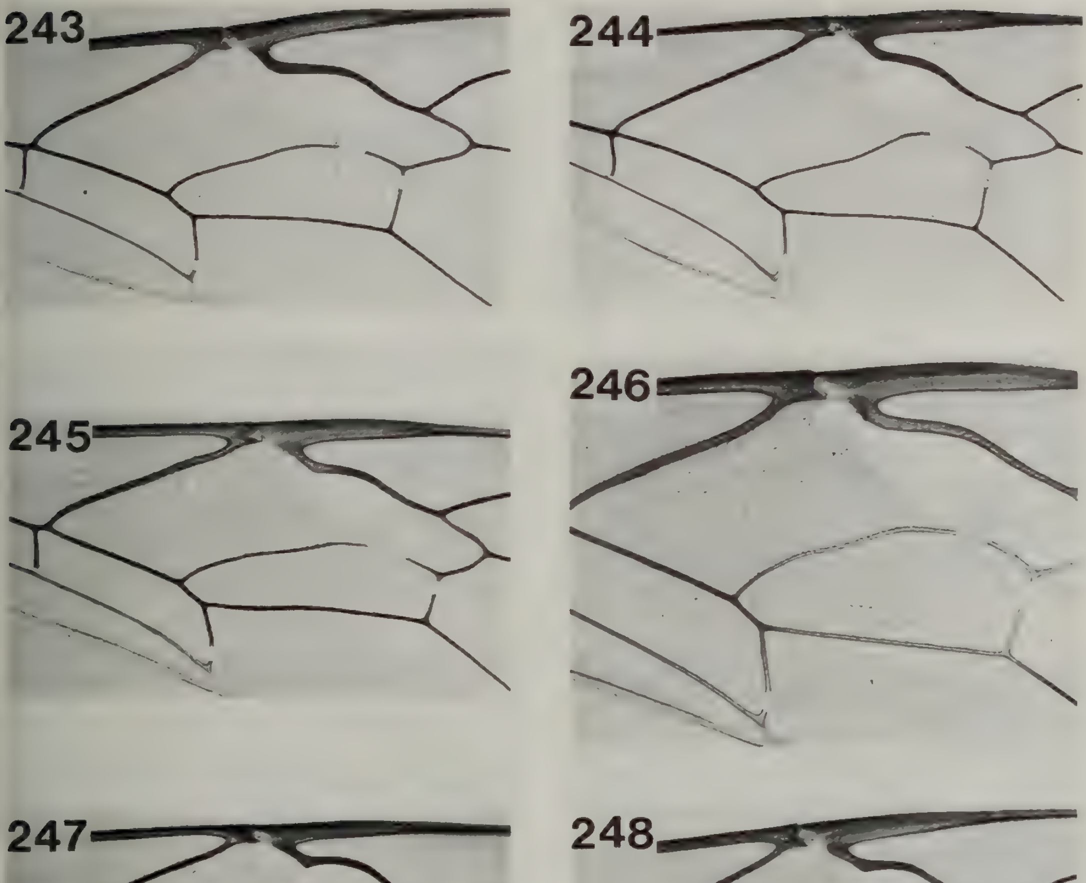
Figs 235–242 *Enicospilus* species, central part of right fore wing in dorsal view; (235) *E. gamezi*; (236) *E. texanus*; (237) *E. cushmani*; (238) *E. halffteri*; (239) *E. sarukhani*; (240) *E. aktites*; (241) *E. gomezpompai*; (242) *E. lebophagus*.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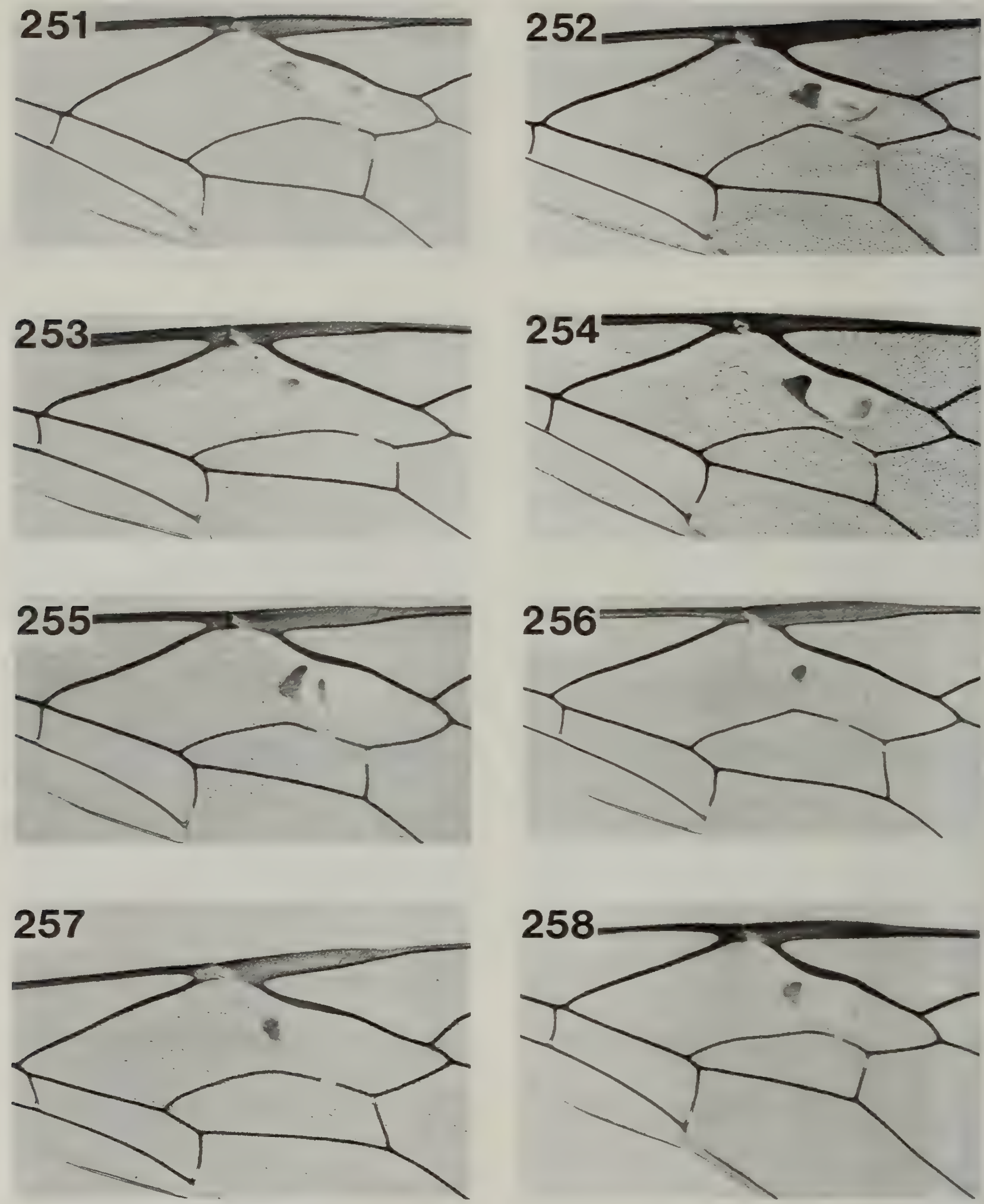
Figs 243–250 *Enicospilus* species, central part of right fore wing in dorsal view; (243) *E. ugaldei*; (244) *E. umanai*; (245) *E. quintanai*; (246) *E. americanus*; (247) *E. tenuigena*; (248) *E. peigleri*; (249) *E. neotropicus*; (250) *E. doylei*.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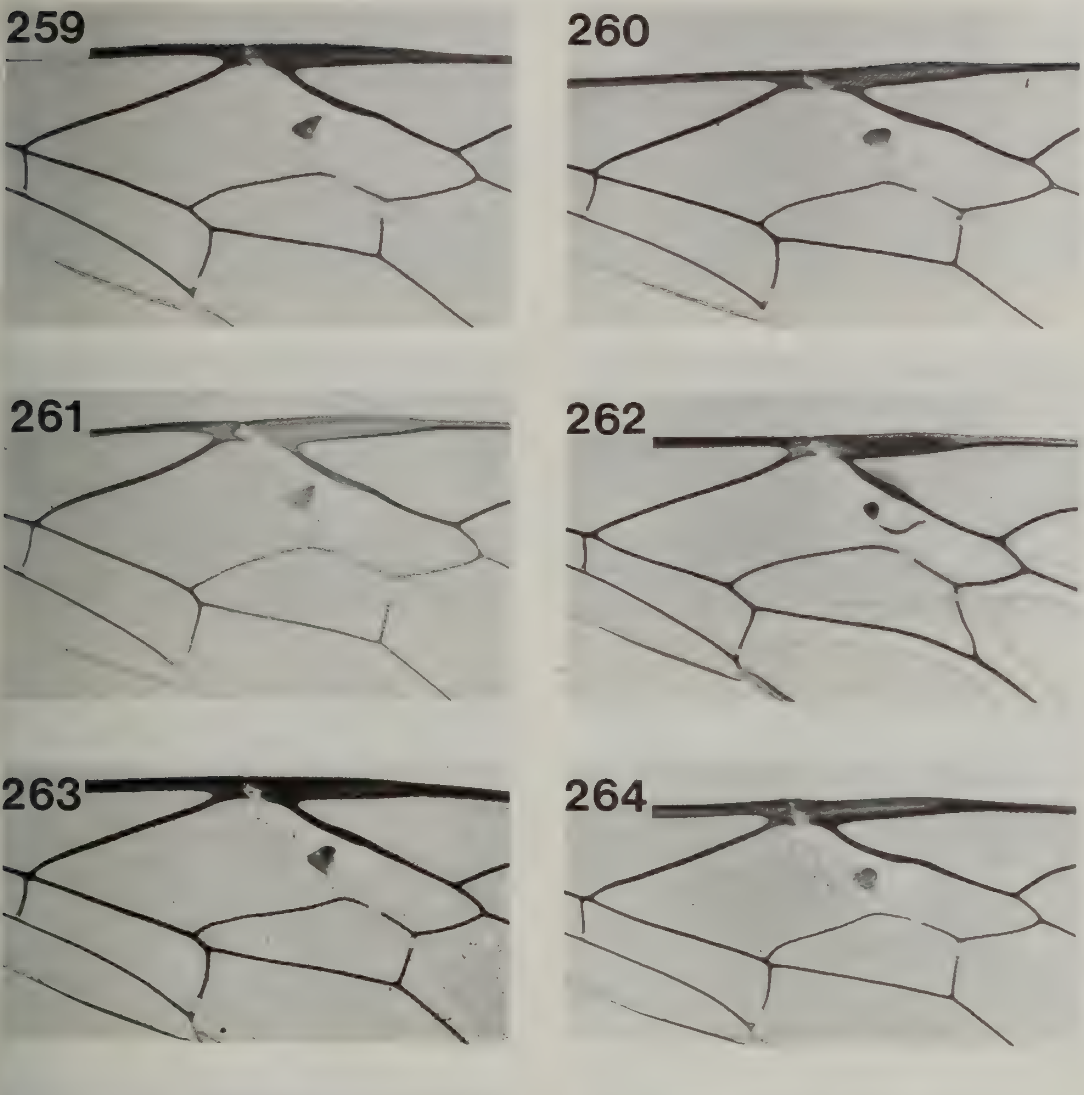
Figs 251–258 *Enicospilus* species, central part of right fore wing in dorsal view; (251) *E. purgatus*; (252) *E. luquillo*; (253) *E. martae*; (254) *E. columbianus*; (255) *E. cubensis*; (256) *E. carlota*; (257) *E. dajaboni*; (258) *E. porteri*.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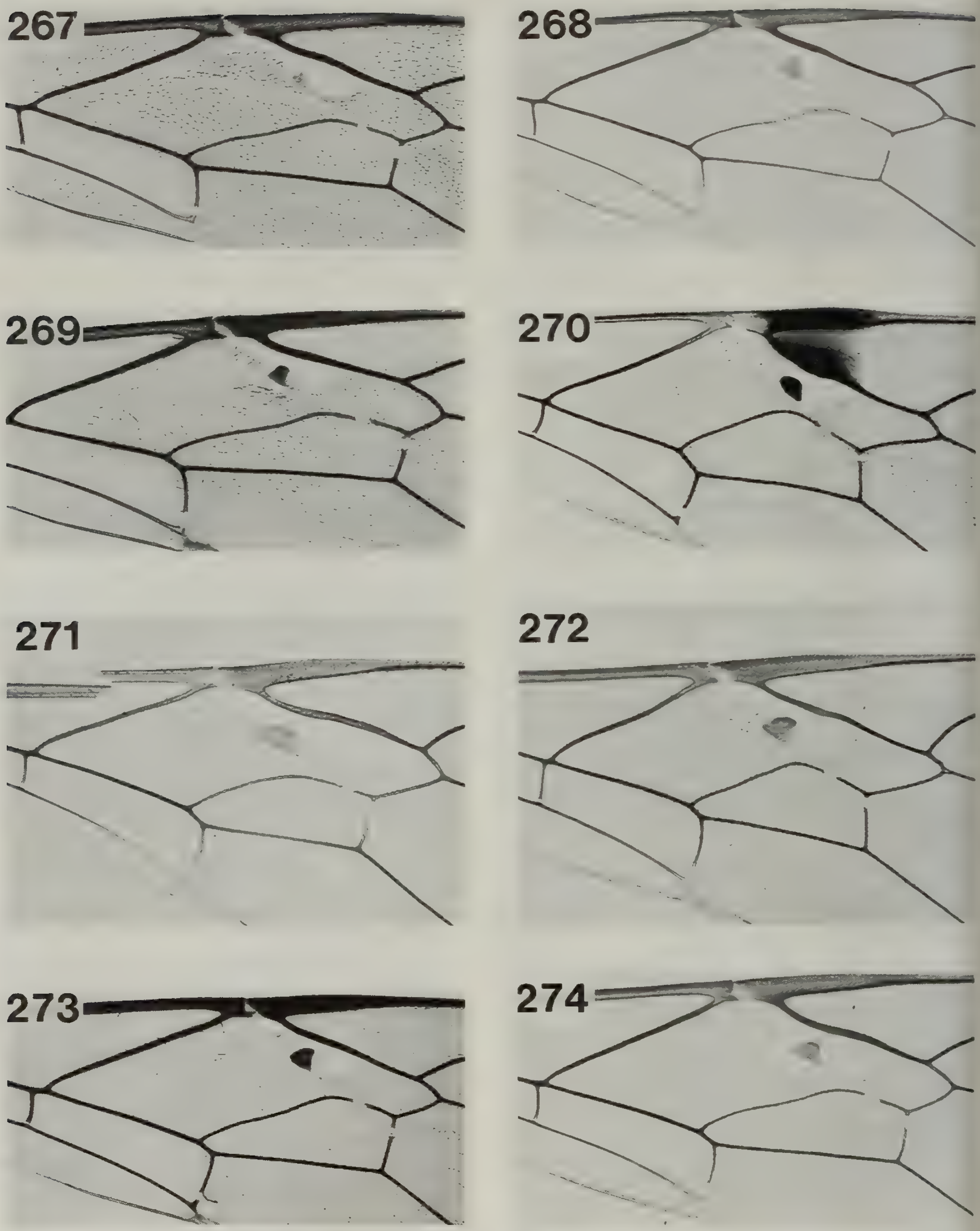
Figs 259–266 *Enicospilus* species, central part of right fore wing in dorsal view; (259) *E. lupemejia*; (260) *E. trilineatus*; (261) *E. dirzoi*; (262) *E. masneri*; (263) *E. randalli*; (264) *E. cressoni*; (265) *E. laurenae*; (266) *E. vegai*.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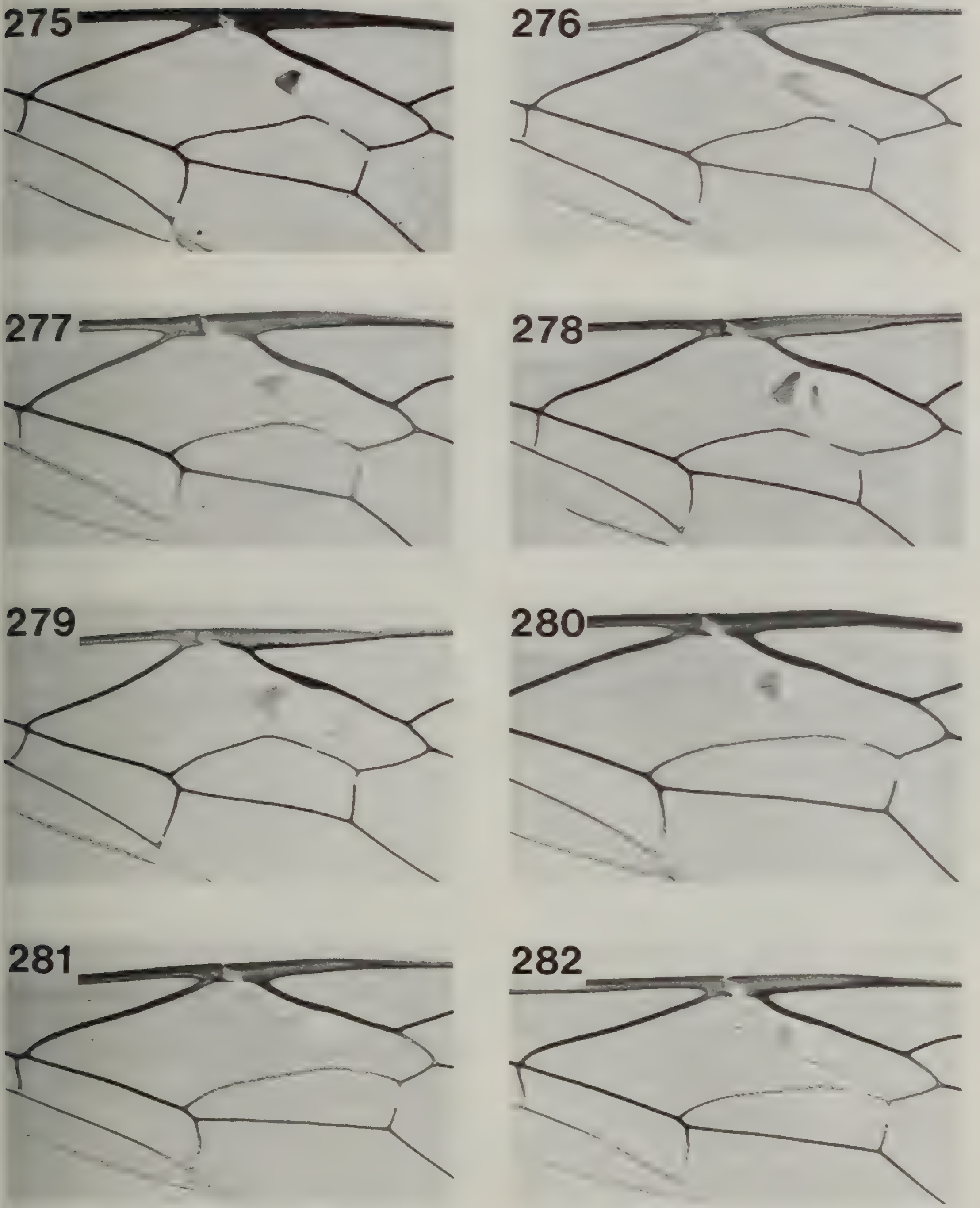
Figs 267–274 *Enicospilus* species, central part of right fore wing in dorsal view; (267) *E. baltodanorum*; (268) *E. carri*; (269) *E. colini*; (270) *E. maculipennis*; (271) *E. guatemalensis*; (272) *E. karrensis*; (273) *E. stevensi*; (274) *E. pamelae*.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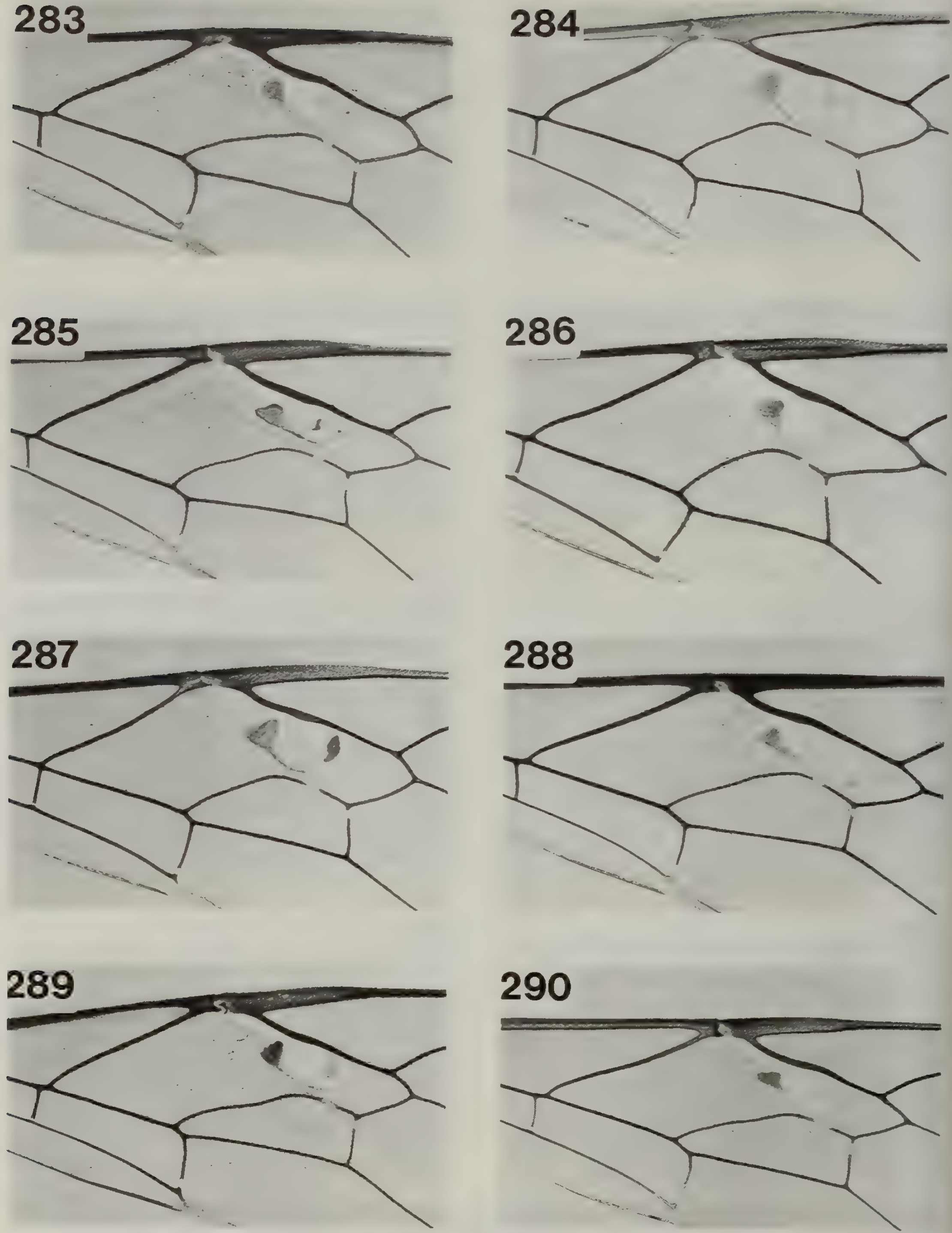
Figs 275–282 *Enicospilus* species, central part of right fore wing in dorsal view; (275) *E. randalli*; (276) *E. vilmari*; (277) *E. estradarum*; (278) *E. cubensis*; (279) *E. teodorae*; (280) *E. maritzai*; (281) *E. exoticus*; (282) *E. jesicae*.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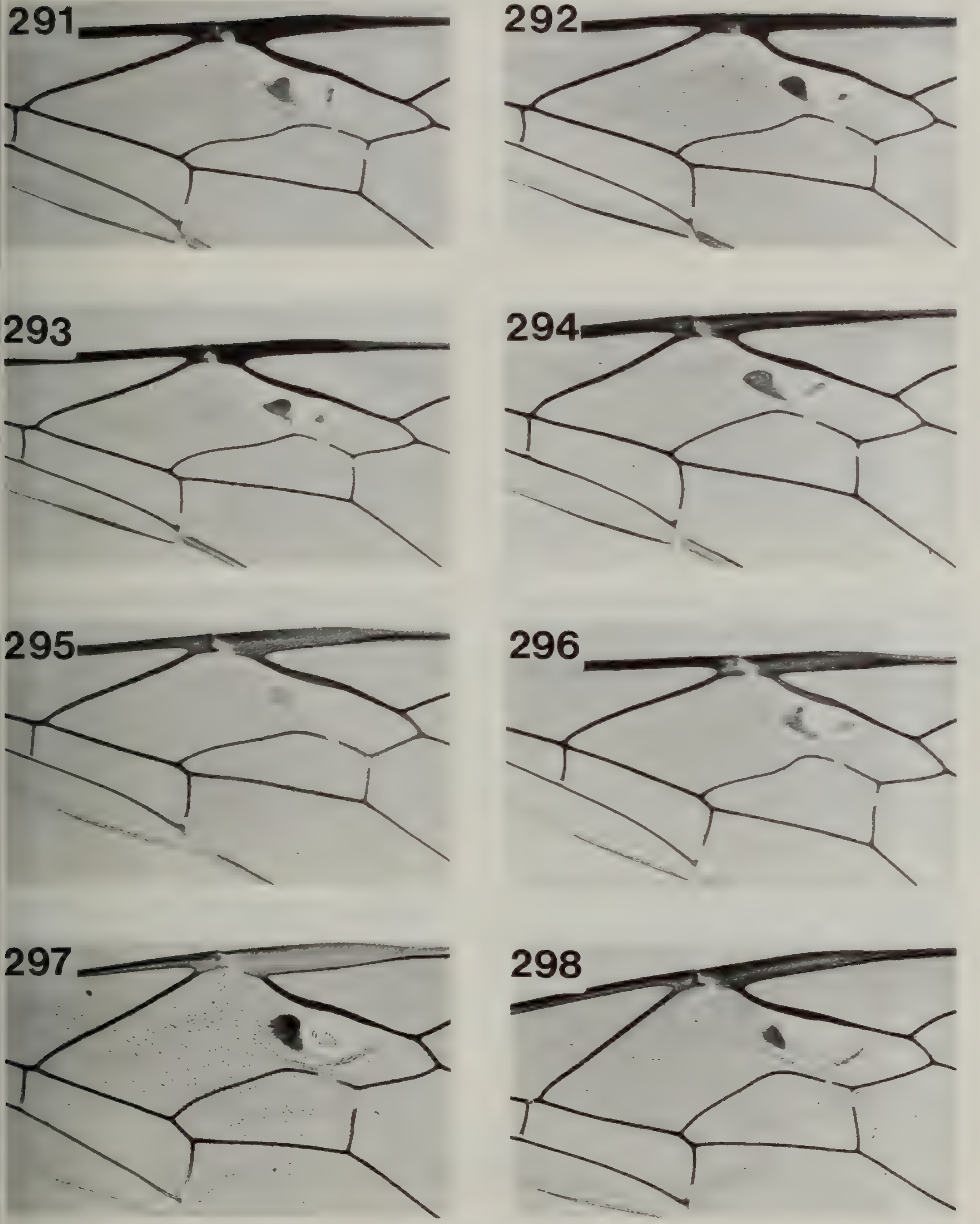
Figs 283–290 *Enicospilus* species, central part of right fore wing in dorsal view; (283) *E. corcovadoi*; (284) *E. lovejoyi*; (285) *E. hacha*; (286) *E. xanthostigma*; (287) *E. cepillo*; (288) *E. persimilis*; (289) *E. fernaldi*; (290) *E. flavus*.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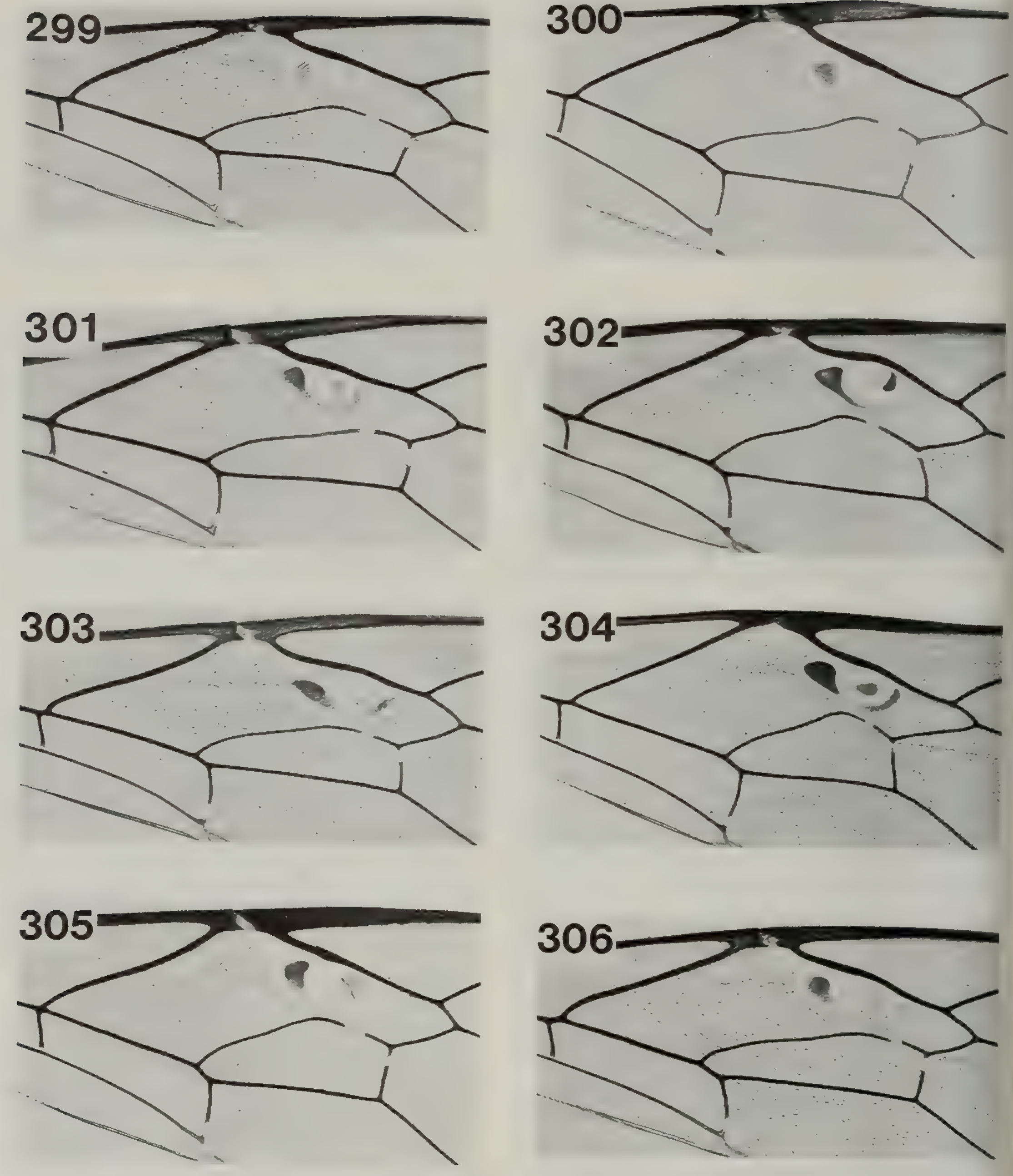
Figs 291–298 *Enicospilus* species, central part of right fore wing in dorsal view; (291–293) *E. monticola*; (294) *E. madrigalae*; (295) *E. xanthocarpus*; (296) *E. duckworthi*; (297) *E. devriesi*; (298) *E. donahuei*.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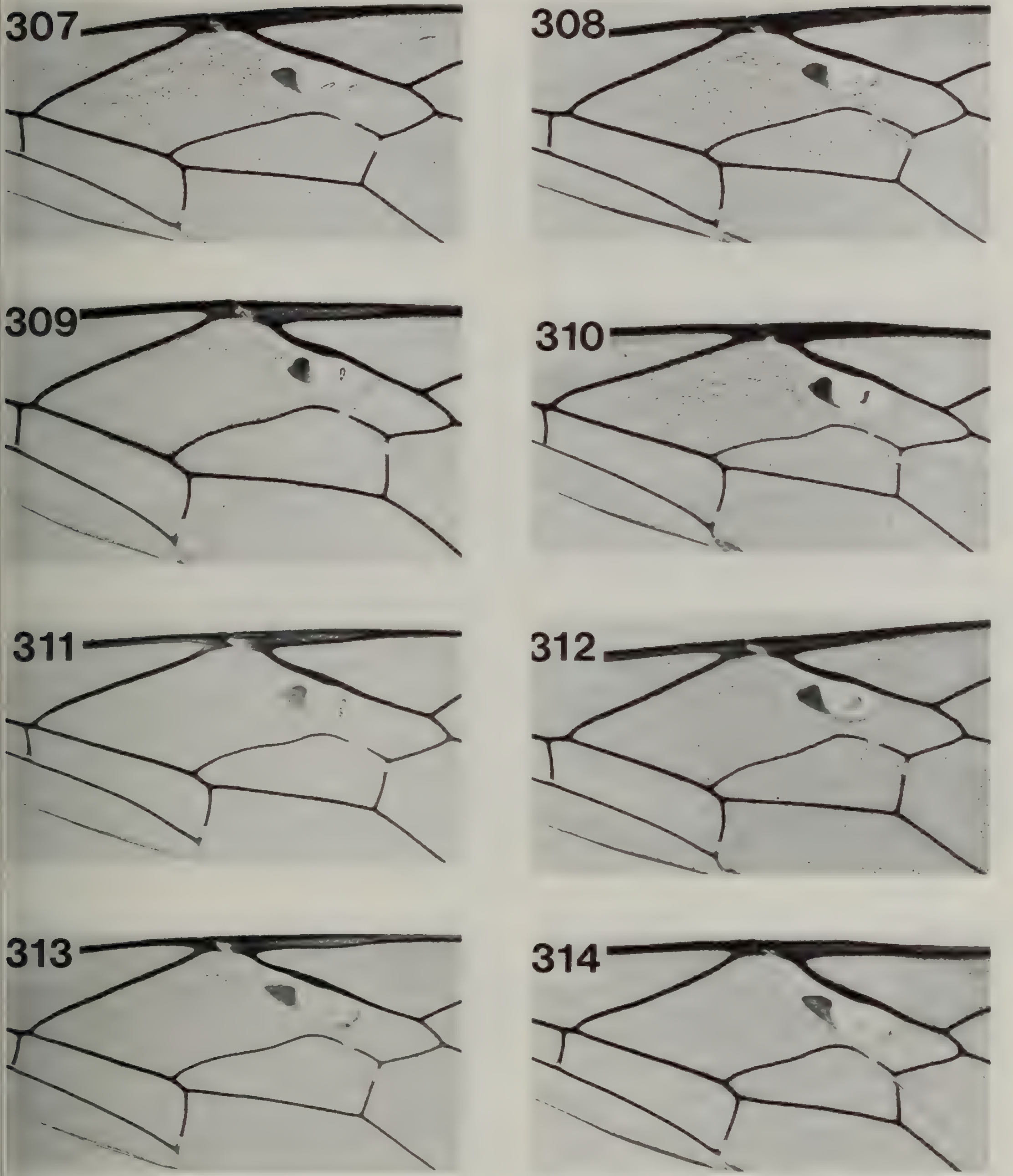
Figs 299–306 *Enicospilus* species, central part of right fore wing in dorsal view; (299) *E. simoni*; (300) *E. orosii*; (301) *E. bima*; (302) *E. barbarae*; (303) *E. forsteri* ; (304) *E. cornifuscus*; (305) *E. catemacoi*; (306) *E. gabrieli*.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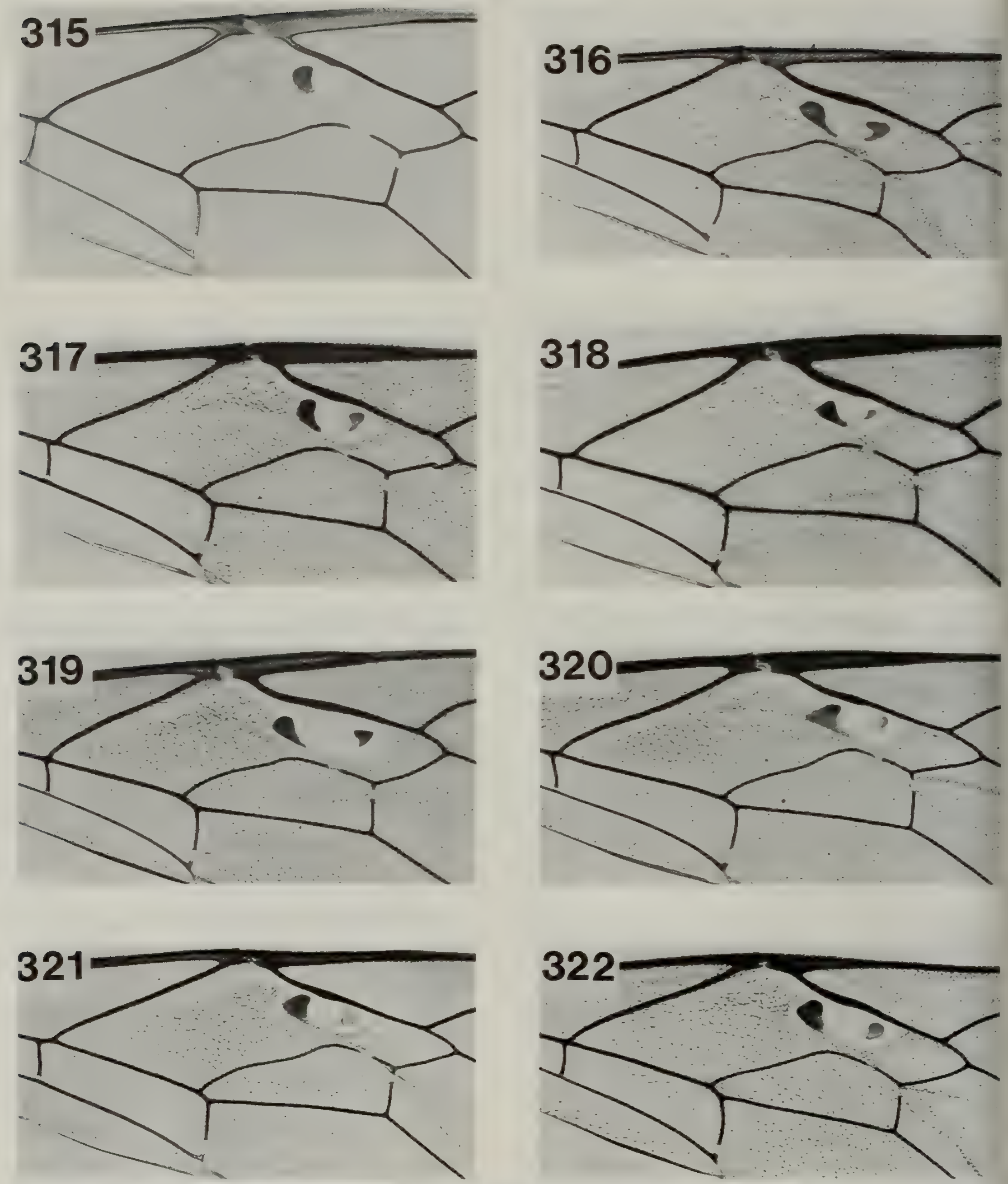
Figs 307–314 *Enicospilus* species, central part of right fore wing in dorsal view; (307, 308) *E. luisi*; (309) *E. guindoni*; (310) *E. monticola*; (311) *E. leoni*; (312) *E. kelloggae*; (313) *E. haberi*; (314) *E. mengoi*.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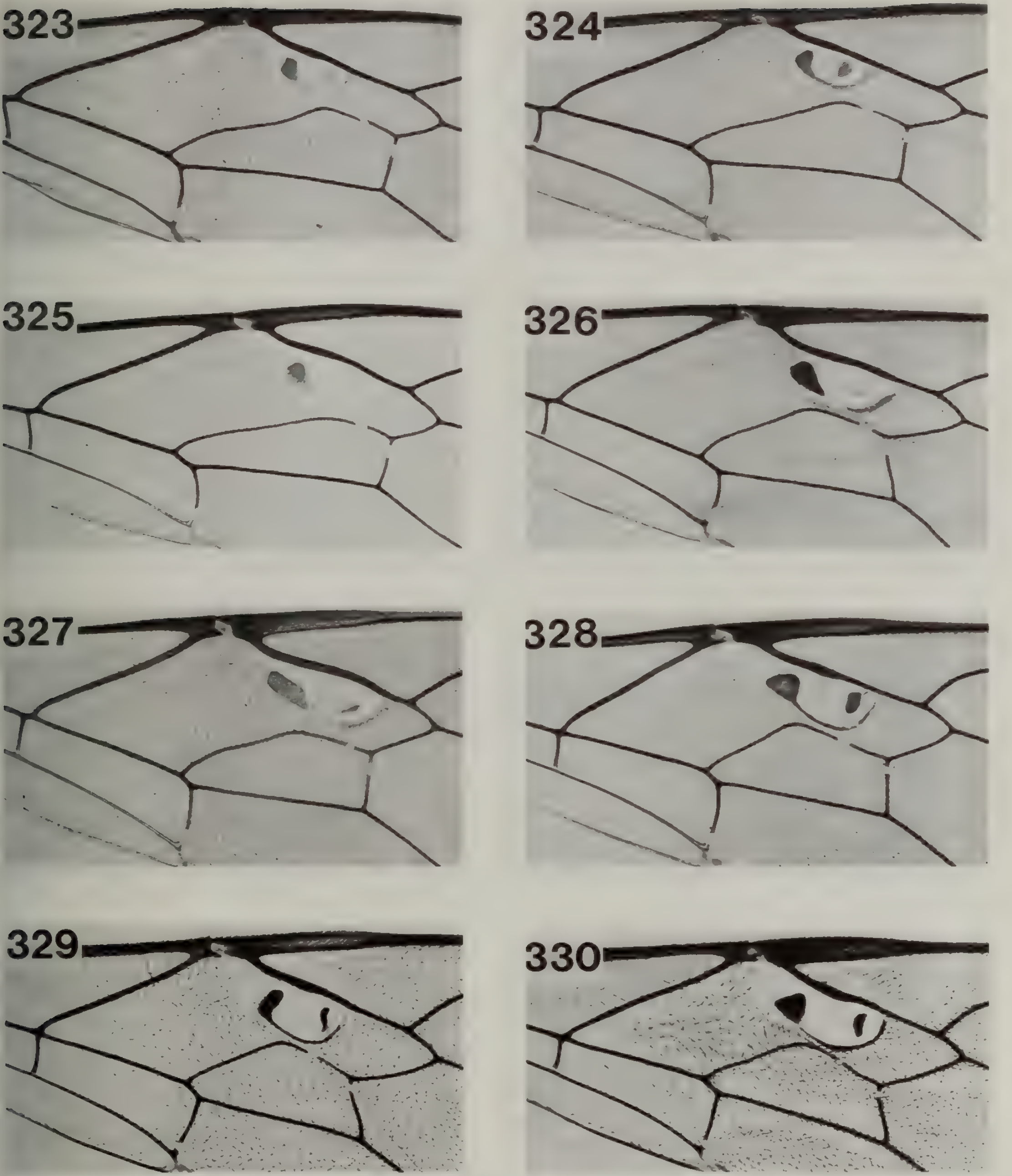
Figs 315–322 *Enicospilus* species, central part of right fore wing in dorsal view; (315) *E. brenesiae*; (316–318) *E. lacsa*; (319) *E. echeverri*; (320) *E. forsythei*; (321) *E. fogdenorum*; (322) *E. burgosi*.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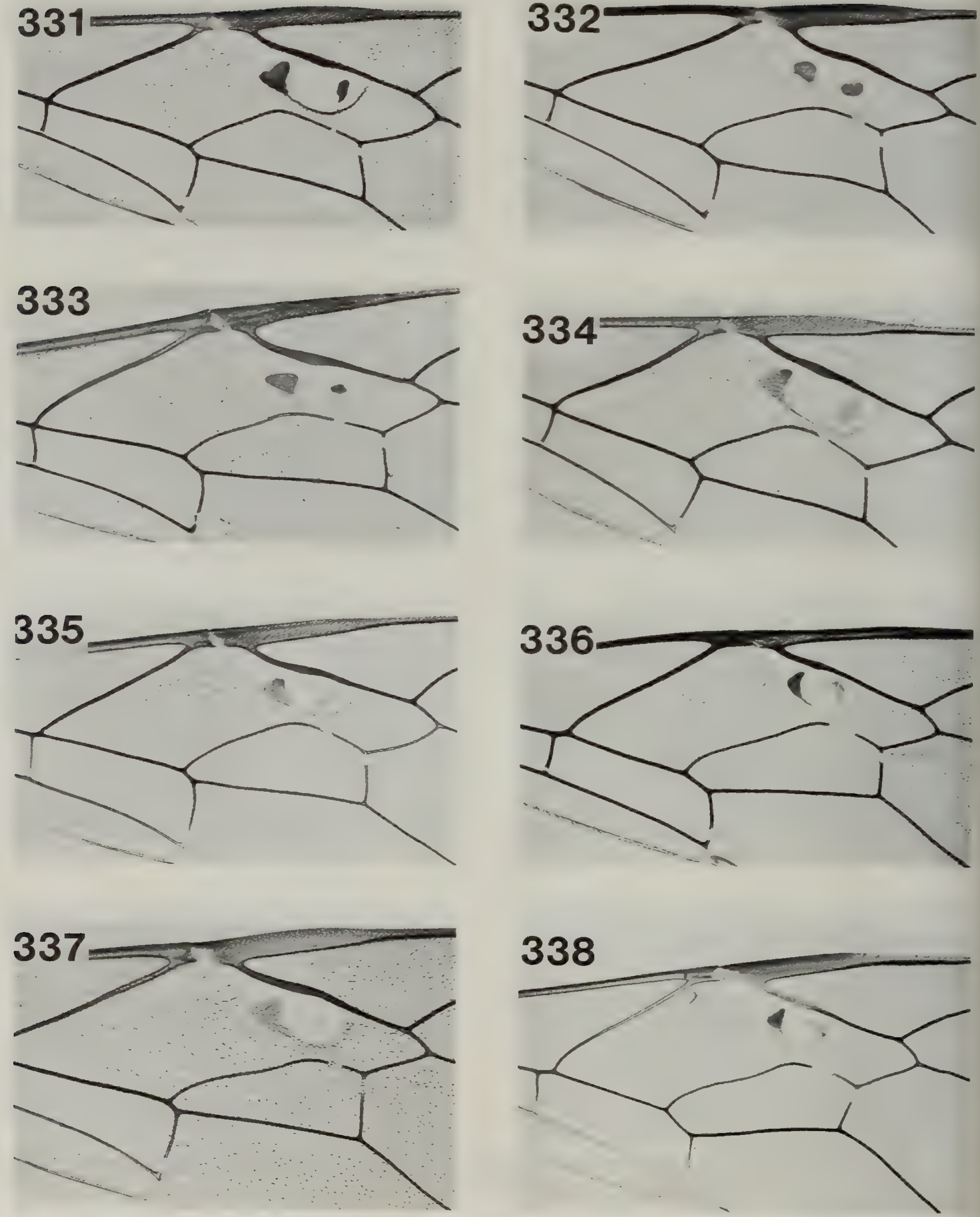
Figs 323–330 *Enicospilus* species, central part of right fore wing in dorsal view; (323) *E. erasi*; (324) *E. galilea*; (325) *E. hubbelli*; (326) *E. flavoscutellatus*; (327) *E. woldai*; (328) *E. liesneri*; (329) *E. marini*; (330) *E. sanchezi*.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Figs 331–338 *Enicospilus* species, central part of right fore wing in dorsal view; (331) *E. pescadori*; (332) *E. howdenorum*; (333) *E. sondrae*; (334) *E. oduberi*; (335) *E. gallegosi*; (336) *E. parkeri*; (337) *E. ulfstrandi*; (338) *E. georginae*.

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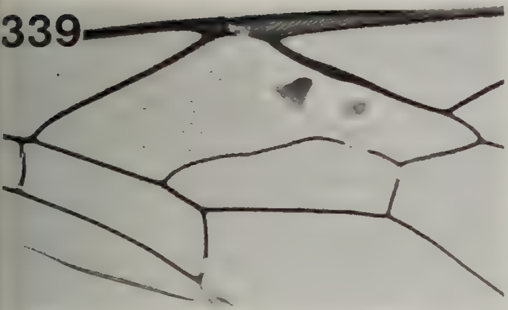

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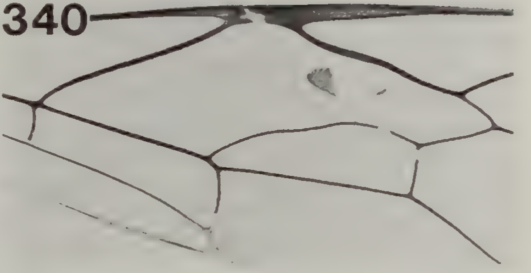

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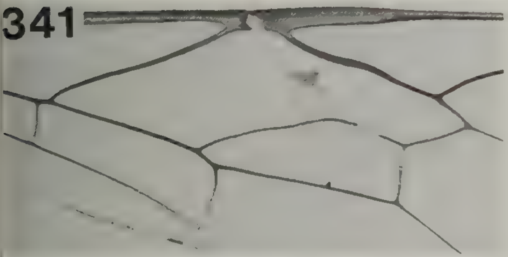

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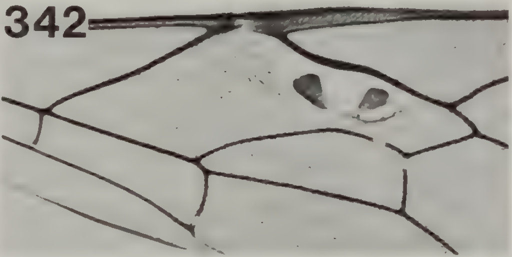

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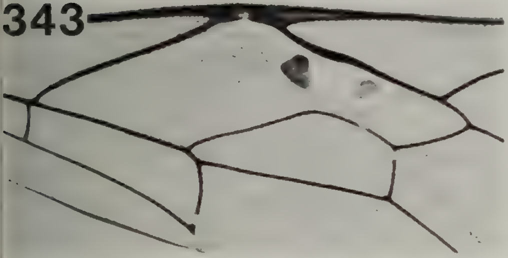

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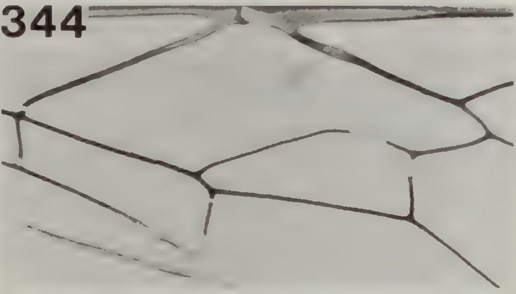

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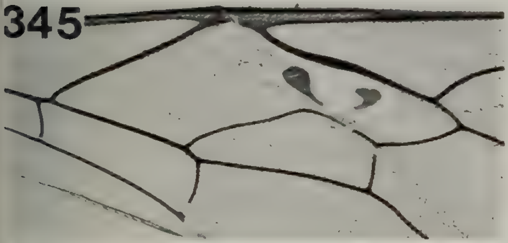

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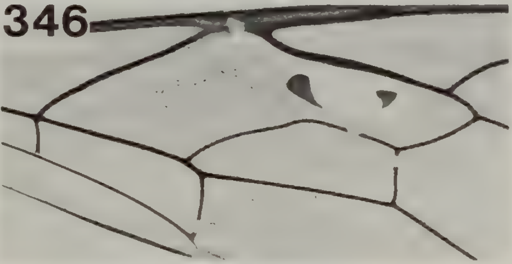
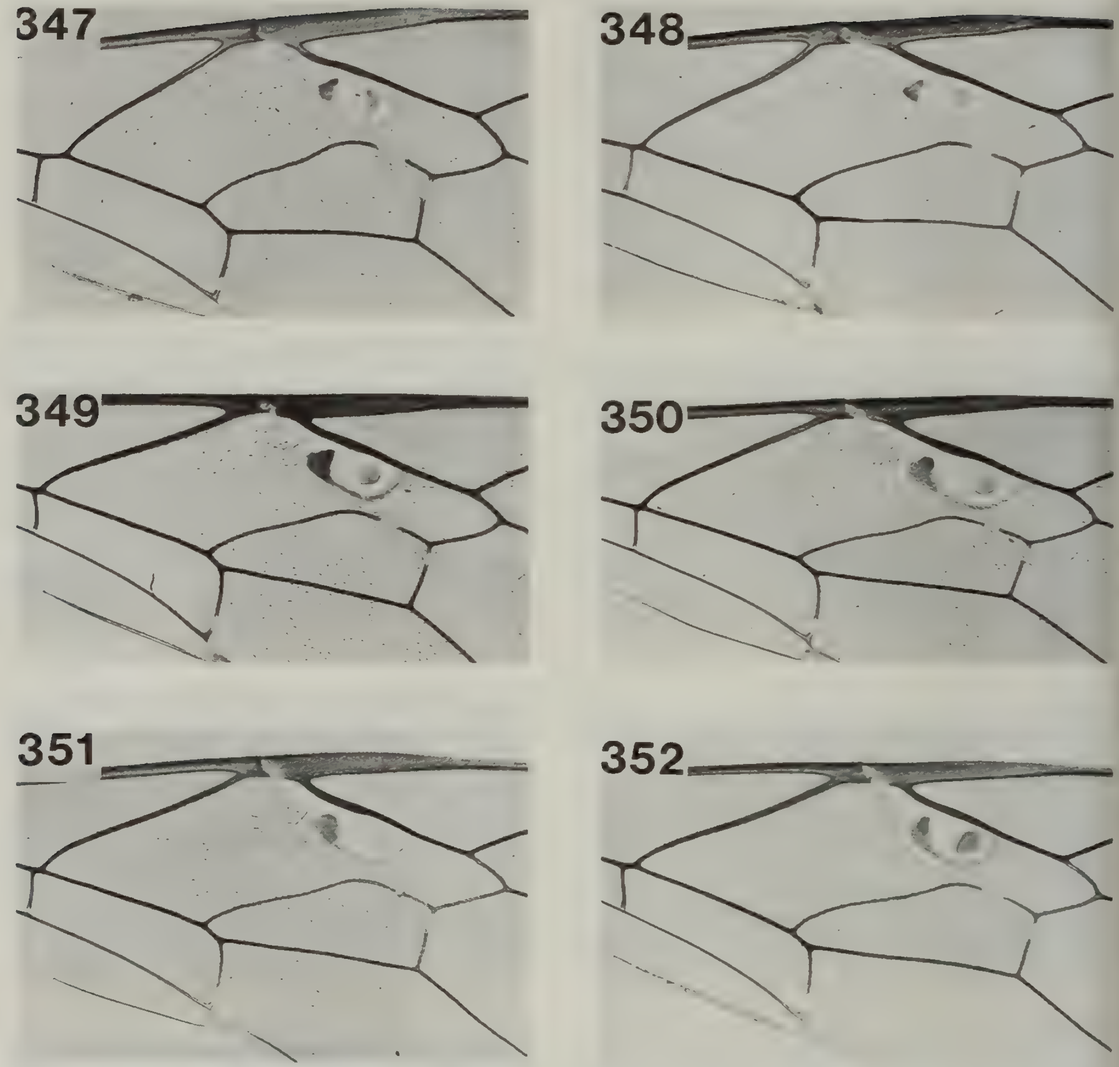


Figs 339–346 *Enicospilus* species, central part of right fore wing in dorsal view; (339) *E. masoni*; (340) *E. kleini*; (341) *E. flavus*; (342) *E. hemicrescellae*; (343) *E. burgosi*; (344) *E. ceciliae*; (345) *E. lacsa*; (346) *E. echeverri*.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Figs 347–352 *Enicospilus dispilus*, central part of right fore wing in dorsal view.

***Enicospilus bozai* sp. n.**

(Figs 83, 147, 149, 219)

DESCRIPTION. Mandibles strongly proximally narrowed, distally more parallel-sided, apically twisted 10–20°; upper mandibular tooth slightly compressed, 1.2–1.4 times as long as the lower tooth; outer mandibular surface centrally flat, with a weak proximal concavity. Labrum 0.2–0.3 times as long as broad; malar space 0.3–0.4 times as long as basal mandibular width. Clypeus in profile flat to very weakly convex, margin subacute; clypeus in front view 1.5–1.6 times as broad as long, with margin truncate apically. Lower face 0.62–0.70 times as broad as long, weakly polished, finely punctate. Head in dorsal view with genae rounded; posterior ocellus close to eye; FI = 75–80%; occipital carina mediodorsally evanescent, usually narrowly interrupted, ventrally abruptly curved to approach the hypostomal carina at about 90°, and with its end evanescent. Antenna slender, with 56–60 flagellar segments; 20th segment 1.4–1.7 times as long as broad.

Mesoscutum granulate, in profile evenly rounded; notauli vestigial. Mesopleuron weakly polished, finely punctate, granulate between punctures; epicnemial carina inclined towards but not reaching the anterior margin of pleuron. Scutellum in profile strongly convex, laterally carinate for 0.5+ of its length; scutellum in dorsal view 1.4–1.5 times as long as anteriorly broad, finely granulate. Metapleuron moderately convex, granulate; submetapleural carina weakly anteriorly broadened; posterior transverse carina of mesosternum usually complete. Propodeum in profile abruptly declivous; anterior transverse carina discontinuous, posterior carina present as a lateral ridge; anterior area short, striate; spiracular area short, granulate; posterior area coarsely irregularly wrinkled, rarely concentrically striate/rugose; lateral longitudinal carina present only anteriorly, not joined to spiracular margin by a short carina (Fig. 149).

Fore wing length 18–21 mm; discosubmarginal cell as in Fig. 219; AI = 0.39–1.20; CI = 0.33–0.57; ICI = 0.93–1.10; SDI = 1.31–1.44; *cu-a* subopposite to slightly proximal to *Rs&M*; marginal cell proximally evenly hairy; 1st subdiscal cell with anterior 0.5 hirsute. Hind wing with 7–9 hamuli on *R*1; 1st abscissa of *Rs* more or less straight, 2nd abscissa straight.

Fore leg with tibia weakly flattened, with scattered stout spines on outer surface. Mid leg with longer tibial spur 1.3–1.4 times length of the shorter. Hind leg with coxa in profile 1.6–1.7 times as long as deep; trochantellus dorsally 0.1 times as long as broad; 4th segment of tarsus 2.2–2.4 times as long as broad; claws of female with long close pectinae, those of male similar.

Gaster stout; tergite 2 in profile 2.3–3.1 times as long as posteriorly deep, laterotergite folded under, thyridia subcircular to oval and separated from anterior margin of tergite by about 1.5–2.0 times its own length. Ovipositor slender, its sheath narrow. Male with sternites 7–9 bearing long, stout very dense pubescence; gonosquama distally pointed (Fig. 147).

Colour generally brownish yellow, head slightly paler; interocellar area yellowish; antenna blackish; pterostigma yellowish brown; wings hyaline.

VARIATION. A morphologically rather uniform species with no remarkable variation.

REMARKS. This species is named in honour of Señor Mario Boza who has done so much to make Costa Rican conservation visible to the international community.

Enicospilus bozai is clearly closely related to *E. enigmus*. Both species have a vein *Rs+2r* in the fore wing more or less straight, have a large ICI and a small CI. Both species also have relatively stout gasters. *E. bozai* also resembles *E. chiriquensis*, a species it is frequently found with in lowland forests. *E. bozai* is generally larger and paler than *E. chiriquensis* but the two differ in other subtle features, as tabulated below.

E. bozai	*E. chiriquensis*
Antenna black	Antenna yellowish brown
Laterotergite 2 upturned	Laterotergite 2 usually pendant
Gonosquama pointed	Gonosquama rounded
Posterior sternites of ♂ bearing very dense, stout erect hairs	Posterior sternites of ♂ bearing moderately sparse, stout, erect hairs

BIOLOGICAL INFORMATION. *Enicospilus bozai* is a Central American species that is most common in lowland wet forests. This species is common in rainforest on Barro Colorado Island, Panama, where it is one of most frequently collected large *Enicospilus*. In this habitat it appears to have two emergence peaks. The seasonal distributional data of specimens in light-traps for 1977/8 and the 36 consecutive months of 1983–5 are:

J	F	M	A	M	J	J	A	S	O	N	D
1	–	2	3	7	11	1	–	1	8	13	2

In dry forests *E. bozai* is much rarer and in Santa Rosa National Park, Costa Rica, the majority of specimens collected were actually reared. Adults fly between June and December in Santa Rosa National Park and the following cumulative seasonal data refer to adults collected at light:

J	F	M	A	M	J	J	A	S	O	N	D
–	–	–	–	–	1	–	2	–	1	–	1

In Santa Rosa National Park *E. bozai* is a solitary endoparasitoid of the larva of *Copaxa moinieri* Lemaire (Lepidoptera: Saturniidae). The host is a moderately large saturniine that, as a larva, feeds on saplings or the lower branches of young trees of *Ocotea veraguensis* (Lauraceae) (Janzen, 1984*a*). *E. bozai* has never been reared from any other insect. However, *C. moinieri* does not occur on Barro Colorado Island, but other species of *Copaxa* do, and they may be hosts.
Rearing data: 81-SRNP-777; 81-SRNP-476X; 81-SRNP-1126, 18–20; 81-SRNP-1169, 27, 29; 84-SRNP-1620.

Material Examined

Holotype ♂, **Costa Rica:** Guanacaste Prov., Santa Rosa National Park, ex *Copaxa moinieri*, 1981 (*Janzen & Hallwachs*) (BMNH).

Paratypes. **Costa Rica:** Guanacaste Prov.: 5 ♂, 1 ♀, same data as holotype, 1981–4 (*Janzen & Hallwachs*) (BMNH); 1 ♂, 1 ♀, same locality as holotype, viii.1982 (*Janzen & Hallwachs*) (BMNH); 1 ♀, same locality, x.1982 (*Janzen & Hallwachs*) (TC); 1 ♂, same locality, xii.1982 (*Janzen & Hallwachs*) (BMNH); 1 ♀, same locality, vi.1984 (*Janzen & Hallwachs*) (BMNH): Puntarenas Prov.: 1 ♂, Corcovado National Park, v.1979 (*Janzen*) (TC); 1 ♂, same locality, xii.1982 (*Janzen & Hallwachs*) (TC); 1 ♂, 1 ♀, same locality, 20 m, v.1984 (*Gauld*) (BMNH). **Panama:** 1 ♀, Barro Colorado Island, vii.1963 (*Cavagnaro & Irwin*) (CAS); 1 ♂, same locality, iv.1965 (*Duckworth*) (USNM); 3 ♂, 11 ♀, same locality, x-xi.1977, iii.-iv.1978 (*Wolda*) (RNH); 2 ♀, same locality, ix-x.1982 (*Wolda*) (TC); 10 ♂, 21 ♀, same locality, 1983–5 (*Wolda*) (BMNH).

***Enicospilus enigmus* sp. n.**

(Figs 84, 148, 150, 220)

Description. Mandibles proximally strongly narrowed, distally more or less parallel-sided, apically twisted 30–40°; upper mandibular tooth subcylindrical, 1.3–1.6 times as long as the lower tooth; outer mandibular surface more or less flat centrally and with a weak proximal concavity and a group of short hairs near the base. Labrum 0.2–0.3 times as long as broad; malar space 0.2–0.3 times as long as basal mandibular width. Clypeus in profile weakly convex, margin subacute, not impressed; clypeus in front view 1.3–1.5 times as broad as long, with margin apically truncate to weakly convex. Lower face 0.65–0.71 times as broad as long, punctate, centrally grading to striate. Head in dorsal view with genae weakly convex; posterior ocellus close to eye; FI = 70–75%; occipital carina mediodorsally complete, ventrally curved to join hypostomal carina about 0.9 times the basal mandibular width away from mandible. Antenna moderately slender, with 63–66 flagellar segments; 20th segment 1.7–1.8 times as long as broad.

Mesoscutum subpolished, finely punctate, in profile weakly rounded; notauli vestigial. Mesopleuron polished, the upper part punctostriate, the lower part striate; epicnemial carina curved towards anterior margin of pleuron. Scutellum in profile moderately convex, laterally carinate for 0.9 or more of its length; scutellum in dorsal view 1.4–1.5 times as long as anteriorly broad, punctate, with striations posteriorly. Metapleuron moderately convex, punctate with diagonal wrinkles; submetapleural carina evenly anteriorly broadened; posterior transverse carina of mesosternum strong laterally, weak centrally. Propodeum in profile abruptly declivous; anterior transverse carina more or less complete, posterior transverse carina present as lateral crest; anterior area striate; spiracular area punctate; posterior area irregularly wrinkled; lateral longitudinal carina usually complete, joined to spiracular margin by a short carina (Fig. 150).

Fore wing length 17–19 mm; discosubmarginal cell as in Fig. 220; AI = 0.69–0.83; CI = 0.17–0.33; ICI = 1.77–2.04; SDI = 1.29–1.41; *cu-a* proximal to base of *Rs&M* by 0.1–0.2 times its own length; marginal cell proximally evenly hirsute; 1st subdiscal cell with anterior and distal margins hirsute. Hind wing with 6–7 hamuli on *R*1; 1st abscissa of *Rs* straight, 2nd abscissa almost straight.

Fore leg with tibia barely flattened, with scattered spines on outer surface. Mid leg with longer tibial spur 1.3–1.4 times length of the shorter. Hind leg with coxa in profile 1.5–1.7 times as long as deep; trochantellus dorsally <0.1 times as long as broad; 4th segment of tarsus 2.4–2.5 times as long as broad; claws of female finely and closely pectinate, those of male similar.

Gaster stout; tergite 1 in profile (immediately before the spiracle) deeper than dorsally broad; tergite 2 in profile 2.5–2.7 times as long as posteriorly deep, laterotergite folded under, thyridia oval to obovate and separated from anterior margin of tergite by about 3 times its own length. Ovipositor slender, its sheath narrow. Males with sternites 7–9 bearing dense long stout erect pubescence; gonosquama truncate (Fig. 148).

Colour generally brownish yellow; interocellar area yellowish; antenna infuscate; pterostigma brownish yellow; wings weakly infumate.

Variation. Four specimens from Brazil and Venezuela differ from Costa Rican material in that the mesoscutum has blackish vittae and the flagellum is yellow. These specimens will not run in the key as they have the gaster slightly more slender and have the fenestra extending to the anterior corner of the discosubmarginal cell. They probably represent an undescribed species, but more material needs to be collected between Costa Rica and Brazil to resolve this question.

Remarks. No other species of *Enicospilus* in Mesoamerica has tergite 1 as stout as that of *E. enigmus*. In general structure it resembles *E. bozai* and *E. exoticus*, and the differences between these species are rather subtle and difficult to appreciate unless reference material is at hand. The following table emphasizes the critical features of the three.

	E. bozai	*E. exoticus*	*E. enigmus*
Interocellar area	yellowish	black	yellowish
Tergite 7 of female	weakly concave	very concave	straight
Ovipositor sheath	slender	stout	slender
Metapleuron	granulate matt	punctate, polished	punctate with striae, polished
Occipital carina	centrally incomplete	complete	complete
Mandible twisted	10–20°	50–60°	30–40°

Biological Information. *Enicospilus enigmus* is widely distributed from northern Costa Rica to southern Brazil. This rare species has been collected in Santa Rosa National Park, Costa Rica, at light only during the dry season in 1983. The distributional data for that year are:

J	F	M	A	M	J	J	A	S	O	N	D
1	1	2	1	1	–	–	–	–	–	–	–

The host of this species is not known, and rather perplexingly, no apparently suitable host larvae for *E. enigmus* are present in Santa Rosa throughout January to May (the dry season).

Material Examined Holotype ♂, **Costa Rica:** Guanacaste Prov., Santa Rosa National Park, 300 m, iii.1983 (*Janzen & Hallwachs*) (BMNH).

Paratypes. **Brazil:** 1 ♀, Mato Grosso, Sinop, 12°31′S 55°37′W, x.1975 (*Alvarenga*) (TC); 1 ♂, Santa Catarina, Nova Teutonia, xii.1952 (*Plaumann*) (TC). **Colombia:** 1 ♀, Dept. Magdalena, Rio Frio, v.1925 (*Walker*) (UM). **Costa Rica:** Guanacaste Prov.: 3 ♂, 2 ♀, Santa Rosa National Park, 300 m, i-v.1983 (*Janzen & Hallwachs*) (BMNH). **Venezuela:** 1 ♂, Aragua, Rancho Grande, iii-iv.1960 (*Test*) (UM); 1 ♀, El Junquito, i.1939 (*Berthier*) (TC).

Enicospilus chaconi sp. n.

(Fig. 85)

Description. Mandibles evenly narrowed, apically twisted 35–45°; upper mandibular tooth slightly depressed, 1.3–1.4 times as long as the lower tooth which is distinctly swollen ventrally, and in front view is much stouter than the upper tooth; outer mandibular surface centrally flat and finely pubescent, with a strong proximal concavity. Labrum 0.3 times as long as broad; malar space 0.3 times as long as basal mandibular width. Clypeus in profile very weakly convex, margin subacute; clypeus in front view 1.4–1.5 times as broad as long, with margin almost truncate. Lower face 0.67–0.69 times as broad as long, weakly convex, finely and evenly punctate. Head in dorsal view with genae evenly rounded; posterior ocellus contiguous with eye; FI = 70–75%; occipital carina mediodorsally complete, ventrally curved to join hypostomal carina about 0.9–1.0 times the basal mandibular width away from mandible. Antenna long and slender, with 64–66 flagellar segments; 20th segment 1.8–1.9 times as long as broad.

Mesoscutum polished, punctate, in profile evenly rounded; notauli vestigial. Mesopleuron polished, the upper part finely punctate, the lower part similar to the upper but with traces of striae; epicnemial carina slightly inclined towards anterior margin of pleuron, its upper end weak but more strongly curved. Scutellum in profile weakly convex, laterally carinate for 0.9+ of its length; scutellum in dorsal view 1.6–1.7 times as long as anteriorly broad, polished, posteriorly wrinkled. Metapleuron moderately convex, polished, punctate with isolated rugae; submetapleural carina strongly anteriorly broadened; posterior transverse carina of mesosternum centrally broadly interrupted or with central part very weak and discontinuous. Propodeum in profile evenly declivous; anterior transverse carina complete, posterior transverse carina absent; anterior area striate; spiracular area smooth with fine punctures; posterior area finely irregularly wrinkled; lateral longitudinal carina weakly discontinuous but present both anteriorly and posteriorly, sometimes joined to spiracular margin by a short weak carina.

Fore wing length 18–19 mm; discosubmarginal cell very similar to that shown in Fig. 222; AI = 0.51–0.73; CI = 0.31–0.35; ICI = 0.85–1.03; SDI = 1.28–1.40; *cu-a* proximal to base of *Rs&M* by 0.3 times its own length; marginal cell proximally evenly hirsute; 1st subdiscal cell anteriorly and distally extensively hirsute. Hind wing with 7–8 hamuli on *R*1; 1st abscissa of *Rs* weakly bowed, 2nd abscissa slightly sinuous.

Fore leg with tibia slightly flattened, with fine scattered spines on outer surface. Mid leg with longer tibial spur 1.2–1.6 times length of the shorter. Hind leg with coxa in profile 1.7–1.8 times as long as deep; trochantellus dorsally <0.1 times as long as broad; 4th segment of tarsus 2.6–2.7 times as long as broad; claws of female finely and closely pectinate, those of male similar.

Gaster moderately slender; tergite 2 in profile 4.4–5.6 times as long as posteriorly deep, laterotergite upturned, thyridia oval and separated from anterior margin of tergite by about 4–5 times its own length. Ovipositor slender, its sheath moderately stout. Male with sternites 7–9 bearing close, dense, semierect pubescence; gonosquama subacute apically.

Colour generally brownish yellow; interocellar area yellowish; antenna blackish; pterostigma yellowish; wings hyaline.

REMARKS. The species is named in honour of Isidro Chacon who has collected many of the ichneumonids examined in this work, and who has done so much to develop an understanding of the Lepidoptera fauna of Costa Rica.

Enicospilus chaconi belongs to a small complex of species that are distinguished by having vein *Rs+2r* in the fore wing very straight, and usually by possessing a very weak vestige of a proximal sclerite. Structurally this group, that is *chaconi*, *clarkorum*, *major* and the tropical South American species *dimidiator* (Fabricius), seems to be more similar to *E. exoticus* and related species than they do to members of the *americanus* complex. *E. chaconi* differs from the other Mesoamerican members of this complex in having an incomplete posterior transverse carina of the mesosternum, a small ICI and a ventrally swollen lower mandibular tooth. It shares these specialized features with *E. dimidiator* from which it differs in size (*dimidiator* is smaller with a fore wing length of 14–16 mm), form of the male sternites (those of *dimidiator* bear sparse scattered erect hairs), and colour (tergites 3+ of the gaster of *dimidiator* are black).

BIOLOGICAL INFORMATION. *Enicospilus chaconi* is only known to occur in Costa Rica where it has been collected in lower montane forests in Braulio Carrillo National Park. Nothing is known about the biology.

MATERIAL EXAMINED

Holotype ♀, **Costa Rica:** San José Prov., Estacion Carrillo, Braulio Carrillo National Park, 700 m, iv.1985 (*Chacon*) (BMNH).

Paratype. 1 ♂, same locality as holotype, iii.1985 (*Chacon*) (BMNH).

Enicospilus clarkorum sp. n.

(Figs 87, 89, 152, 223)

DESCRIPTION. Mandibles evenly tapered, apically twisted 40–45°; upper mandibular tooth slightly depressed, 1.4–1.6 times as long as the lower tooth which is slightly compressed and very sharp along inner surface; outer mandibular surface weakly concave, punctostriate centrally and bearing fine hairs. Labrum 0.2–0.3 times as long as broad; malar space 0.3–0.4 times as long as basal mandibular width. Clypeus in profile weakly convex, margin blunt; clypeus in front view 1.4–1.5 times as broad as long, with margin truncate. Lower face 0.67–0.69 times as broad as long, polished, finely punctate. Head in dorsal view with genae evenly narrowed; posterior ocellus contiguous with eye; FI = 70–75%; occipital carina mediodorsally complete, ventrally curved to join hypostomal carina about 0.8 times the basal mandibular width away from mandible. Antenna long and slender, with 63–65 flagellar segments; 20th segment 1.9–2.1 times as long as broad.

Mesoscutum weakly polished, finely punctate, in profile evenly rounded; notauli vestigial. Mesopleuron polished, the upper part punctate, the lower part punctostriate; epicnemial carina curved towards anterior margin of pleuron. Scutellum in profile weakly convex, laterally carinate for 0.8+ of its length; scutellum in dorsal view 1.5–1.6 times as long as anteriorly broad, smooth, posteriorly striate. Metapleuron punctate, with diagonal striae extending from propodeum; submetapleural carina quite strongly anteriorly broadened; posterior transverse carina of mesosternum complete. Propodeum in profile abruptly declivous; anterior transverse carina complete, posterior transverse carina represented by lateral crests; anterior area short, deep, striate; spiracular area short and smooth; posterior area with transverse rugae, tending to concentrically striate; lateral longitudinal carina present only anteriorly, joined to spiracular margin by a short carina.

Fore wing length 19–21 mm; discosubmarginal cell as in Fig. 223; AI = 0.88–1.00; CI = 0.20–0.47; ICI = 1.42–1.96; SDI = 1.35–1.42; *cu-a* slightly proximal to base of *Rs&M*; marginal cell proximally evenly hirsute; 1st subdiscal cell with anterior 0.5 and distal margin hirsute. Hind wing with 9–10 hamuli on *R*1; 1st abscissa of *Rs* straight, 2nd abscissa weakly bowed.

Fore leg with tibia subcylindrical, with fine, scattered spines on outer surface. Mid leg with longer tibial spur 1.3–1.4 times length of the shorter. Hind leg with coxa in profile 1.7–1.8 times as long as deep; trochantellus dorsally 0.1 times as long as broad; 4th segment of tarsus 2.2–2.3 times as long as broad; claws of female large, with long stout sparse pectinae (Fig. 152), those of male with pectinae shorter and closer.

Gaster long and slender; tergite 2 in profile 4.0–5.0 times as long as posteriorly deep, laterotergite upturned, thyridia oval and separated from anterior margin of tergite by about 3–4 times its own length. Ovipositor slender, its sheath moderately stout. Male unusual in having sternites 7–9 bearing dense bands on long erect hairs on their posterior margins, and finer semidecumbent hair over remainder of sternites (Fig. 89); gonosquama truncate.

Colour generally reddish brown, tergite 3+ infuscate; interocellar area orange, blackish between posterior ocelli; antenna black; pterostigma infuscate; wings infumate.

REMARKS. This species is named after Deborah and David Clark who have played a central role in the development of the Finca La Selva biological station of the Organization for Tropical Studies.

Enicospilus clarkorum is one of three Mesoamerican species (the others being *E. chaconi* and *E. major*) that have a straight *Rs+2r*, a vestige of a proximal sclerite, and a slender gaster. *E. clarkorum* differs from these other species in having the tarsal claws of the female sparsely pectinate, and the males may be distinguished by differences in hair patterns on the terminal gastral sternites (see key)

BIOLOGICAL INFORMATION. *Enicospilus clarkorum* is widely distributed from central Costa Rica southwards to Peru and Brazil. Most specimens have been collected in wet lowland forest. The host of this species is unknown.

MATERIAL EXAMINED

Holotype ♀, **Costa Rica:** Heredia Prov., Finca la Selva, 4 km E. of Puerto Viejo, iii.1980 (*Schal*) (USNM).

Paratypes. **Brazil:** 1 ♂, Amazonas, Tabatinga, x.1958 (*Tatico*) (TC); 1 ♀, Mato Grosso, Sinop, 12°31'S 55°37'W, x.1976 (*Alvarenga*) (TC). **Peru:** 1 ♂, Cuzco, Atalaya, Río Tambo, iii.1954 (*Schunke*) (BMNH); 1 ♂, Satipo, vii.1943 (*Paprzyck*) (TC).

Enicospilus major (Morley)

(Figs 86, 88, 151, 222)

Henicospilus major Morley, 1912: 36. Lectotype ♀, GUYANA, designated by Townes & Townes (1966: 181) (BMNH) [examined].

Enicospilus major (Morley) Townes & Townes, 1966: 181.

DESCRIPTION. Mandibles evenly tapered, apically twisted 40–45°; upper mandibular tooth slightly depressed, 1.4–1.6 times as long as the lower tooth which is slightly compressed and very sharp along inner surface; outer mandibular surface weakly concave, punctostriate centrally and bearing fine hairs. Labrum 0.2–0.3 times as long as broad; malar space 0.3–0.4 times as long as basal mandibular width. Clypeus in profile weakly convex, margin blunt; clypeus in front view 1.4–1.5 times as broad as long, with margin truncate. Lower face 0.66–0.69 times as broad as long, polished, finely punctate. Head in dorsal view with genae evenly narrowed; posterior ocellus contiguous with eye; FI = 70–75%; occipital carina mediodorsally complete, ventrally curved to join hypostomal carina about 0.8 times the basal mandibular width away from mandible. Antenna long and slender, with 61–65 flagellar segments; 20th segment 1.9–2.1 times as long as broad.

Mesoscutum weakly polished, finely punctate, in profile evenly rounded; notauli weakly impressed. Mesopleuron polished, the upper part punctate, the lower part punctate to weakly coriaceous; epicnemial carina curved towards anterior margin of pleuron. Scutellum in profile weakly convex, laterally carinate for most of its length; scutellum in dorsal view 1.4 times as long as anteriorly broad, finely punctate, posteriorly slightly wrinkled. Metapleuron evenly and moderately convex, punctate; submetapleural carina evenly anteriorly broadened; posterior transverse carina of mesosternum complete. Propodeum in profile abruptly declivous; anterior transverse carina complete, posterior one absent or represented by weak crests laterally; anterior area short, deeply impressed and almost smooth; spiracular area moderately long, smooth; posterior area irregularly wrinkled; lateral longitudinal carina present anteriorly, not joined to spiracular margin by a short carina.

Fore wing length 16–18 mm; discosubmarginal cell as in Fig. 222; AI = 0.60–0.67; CI = 0.25–0.42; ICI = 1.10–2.03; SDI = 1.13–1.28; *cu-a* proximal to base *Rs&M* by 0.1–0.3 times its own length; marginal cell proximally evenly hirsute; 1st subdiscal cell with anterior and distal parts extensively hirsute. Hind wing with 7–8 hamuli on *R*1; 1st abscissa of *Rs* straight, 2nd abscissa straight.

Fore leg with tibia subcylindrical, with numerous spines on outer surface. Mid leg with longer tibial spur 1.3–1.4 times length of the shorter. Hind leg with coxa in profile 1.7–1.8 times as long as deep; trochantellus dorsally 0.1 times as long as broad; 4th segment of tarsus 2.3–2.6 times as long as broad; claws of female abruptly curved with close short pectinae (Fig. 151), claws of male similar.

Gaster slender; tergite 2 in profile more than 5 times as long as posteriorly deep, laterotergite folded under, thyridia obovate to elliptical, separated from anterior margin of tergite by about 3 times its own length. Ovipositor slender, its sheath narrow. Male with sternites 7–9 bearing dense suberect pubescence (Fig. 88); gonosquama apically evenly rounded.

Colour generally reddish brown, head rather paler yellowish, mesoscutum generally with three longitudinal dark vittae; gaster with tergites 3+ infuscate; interocellar area yellowish orange, at most slightly infuscate between posterior ocelli; antenna strongly infuscate; pterostigma reddish brown; wings very weakly infumate.

VARIATION. The female from Brazil does not have dark mesoscutal vittae.

REMARKS. *Enicospilus major* closely resembles *E. clarkorum* in general structure and coloration, but differs conspicuously in two features, the form of the tarsal claws of the female – those of *major* are closely and finely pectinate whereas those of *clarkorum* have long sparse pectinae – and the pubescence of the terminal sternites of the male – *clarkorum* males have a highly autapomorphic hair pattern (see Fig. 89).

BIOLOGICAL INFORMATION. *Enicospilus major* is a fairly widely distributed species whose range extends from Panama south to Brazil. The single Mesoamerican specimen that I have seen was collected at light in a relatively undisturbed wet forest at an altitude of 1050 m in northern Panama. Its host is unknown.

MATERIAL EXAMINED

Lectotype ♀, **Guyana:** Essequibo River, 1908 (*Rodway*) (BMNH).

Brazil: 1 ♀, Mato Grosso, Sinop, x.1976 (*Alvarenga*) (TC). **Ecuador:** 1 ♂, Napo, Muyuna, 5 km W. Tena, 550 m, viii.1979 (*Cooper*) (BMNH). **Panama:** 1 ♂, Chiriqui Prov., Fortuna, 1050 m, iv.1978 (*Wolda*) (RNH). Surinam: 1 ♂, Kabelstation, x.1946 (*Geijskes*) (TC). **Venezuela:** 1 ♀, Caracas, Colonia Tovar, 1700 m, x.1938 (TC).

Enicospilus glabratus (Say)

(Fig. 224)

[*Ophion glabratus* Harris, 1835: 585. Nomen nudum.]

Ophion glabratus Say, 1836: 239. Holotype, U.S.A.: Indiana destroyed.

[*Ophion arctiae* Riley & Howard, 1890: 155. Nomen nudum.]

Eremotylus arctiae Ashmead, 1896: 192. Lectotype ♀, U.S.A.: (USNM), designated by Hooker (1912: 147) [examined]. [Synonymized by Townes, 1945: 742.]

Allocamptus cubitalis Morley, 1912: 25. Lectotype ♀, MEXICO: Guerrero (BMNH), designated by Townes & Townes (1966: 180) [examined]. Junior primary homonym of *Allocamptus cubitalis* Szépligeti, 1906. [Synonymized by Townes & Townes, 1966: 180.]

Eremotylus angulatus Hooker, 1912: 144. Lectotype ♀, PUERTO RICO (PANS), designated by Cresson (1928: 12) [examined]. **Syn. n.**
Eremotylus arctiae Ashmead; Hooker, 1912: 146.
Allocamptus cubitalis Morley; Hancock, 1926: 170.
Eremotylus macrurus angulatus Hooker; Cresson, 1928: 12.
Eremotylus glabratus (Say) Wolcott, 1936: 517.
Enicospilus cubitalis (Morley) Townes, 1945: 742.
Enicospilus glabratus (Say) Townes, 1945: 742.
Eremotylus glabratus Say; Bruner *et al.*, 1945: 135.
Enicospilus angulatus (Hooker) Townes, 1946: 46.
Enicospilus angulatus (Hooker); Wolcott, 1948: 769.
Enicospilus excubitalis Walkley, 1958: 62. Replacement name for *cubitalis* Morley.

DESCRIPTION. Mandibles moderately long, basally quite strongly narrowed but distally more parallel-sided, apically twisted 15–35°; upper mandibular tooth slightly compressed, 1.3–1.7 times as long as the lower tooth; outer mandibular surface centrally flat, matt, with scattered fine pubescence, with a weak proximal concavity. Labrum 0.2–0.3 times as long as broad; malar space 0.2–0.3 times as long as basal mandibular width. Clypeus in profile from flat to weakly convex, margin flat, not impressed, subacute to acute; clypeus in front view 1.2–1.5 times as broad as long, with margin truncate or subtruncate. Lower face 0.65–0.70 times as broad as long, shallowly punctate and often granulate between punctures. Head in dorsal view with genae evenly narrowed; posterior ocellus very close to or contiguous with eye; FI = 65–75%; occipital carina mediodorsally complete, ventrally curved to join hypostomal carina 0.8–1.1 times the basal mandibular width away from mandible. Antenna long and slender, with 54–65 flagellar segments; 20th segment 1.9–2.1 times as long as broad.

Mesoscutum closely punctate, in profile evenly rounded; notauli weakly impressed but discernible. Mesopleuron weakly polished, punctate to punctostriate; epicnemial carina inclined towards anterior margin of pleuron, its upper end evanescent, its lower corner slightly protuberant. Scutellum in profile weakly convex, laterally carinate for 0.7 or more of its length; scutellum in dorsal view 1.4–1.6 times as long as anteriorly broad, anteriorly sparsely punctate to granulate, posteriorly wrinkled. Metapleuron moderately convex, granulate, punctate to punctostriate; submetapleural carina evenly anteriorly broadened; posterior transverse carina of mesosternum complete, often sinuous. Propodeum in profile evenly declivous; anterior transverse carina strong, complete, posterior transverse carina usually discernible as lateral keels; anterior area broad, deeply excavate, striate; spiracular area short and finely granulate; posterior area coarsely irregularly wrinkled to concentrically striate; lateral longitudinal carina present anteriorly, less commonly almost complete, not joined to spiracular margin by a short carina.

Fore wing length 14–21 mm; discosubmarginal cell as in Fig. 224; AI = 1.23–2.20; CI = 0.44–0.72; ICI = 0.26–0.56; SDI = 1.16–1.43; *cu-a* proximal to base of *Rs&M* by 0.2–0.4 times its own length; marginal cell proximally slightly more sparsely hirsute close to *Rs+2r*; 1st subdiscal cell proximally and anteriorly sparsely hirsute. Hind wing with 7–9 hamuli on *R*1; 1st abscissa of *Rs* more or less straight, 2nd abscissa weakly arcuate.

Fore leg with tibia subcylindrical, with scattered spines on outer surface. Mid leg with longer tibial spur 1.3–1.5 times length of the shorter. Hind leg with coxa in profile 1.8–1.9 times as long as deep; trochantellus dorsally 0.1–0.3 times as long as broad; 4th segment of tarsus 2.6–2.8 times as long as broad; claws of female large, abruptly curved, with long stout widely scattered pectinae, those of male similar but with shorter closer pectinae.

Gaster moderately slender; tergite 2 in profile 4.0–7.0 times as long as posteriorly deep, laterotergite folded under, thyridia obovate to elliptical and separated from anterior margin of tergite by about 3–4 times its own length. Ovipositor slender, its sheath narrow. Male with sternites 7–9 bearing few fine scattered hairs; gonosquama evenly rounded.

Colour generally brownish yellow; interocellar area paler yellowish; antenna brownish yellow; pterostigma yellowish; wings hyaline.

VARIATION. The usual size range of the fore wings (i.e. that of about 95% of specimens seen) is between 14 and 21 mm in length. A few individuals are exceptionally large or small, with a fore wing length range from 9 to 24 mm. Very small specimens often are rather weakly sculptured. Many specimens have the posterior segments of the gaster somewhat infuscate, but a few specimens from Jamaica and other West Indian islands have the posterior margins of tergites 3–5 infuscate, which gives a banded appearance to the gaster. Some of these large individuals have a well-developed prominence on the posterior margin of *Rs+2r* in the fore wing. The lectotype of *E. angulatus* Hooker is such a specimen.

Remarks. This is one of the most distinctive American species of *Enicospilus*. It may easily be recognized by the characteristic shape of the alar fenestra and the presence of a clump of close-packed hairs in the anterior corner of the discosubmarginal cell. Unlike many other species in the *E. americanus* complex, the lower part of the occipital carina of this species joins the hypostomal carina.

Biological Information. *Enicospilus glabratus* is one of the commonest and most widely distributed American species of the genus. Its cumulative range extends from about 42°N in the U.S.A., south to about 32°S in Argentina and Brazil (Map 4). It is widely distributed throughout Mesoamerica, and is one of the most frequently collected species at many sites from sea level to 1500 m, though it appears to be least abundant in pristine lowland rain forest. For example, no specimens were found to be present in two years light-trap collections from Barro Colorado Island, Panama, nor has it been collected in Corcovado or Tortuguero National Parks, Costa Rica.

In Santa Rosa National Park, Costa Rica, *E. glabratus* has been collected during every month of the year, including the dry season when no hosts are available. The cumulative seasonal distributional data for 1983–5 are:

J	F	M	A	M	J	J	A	S	O	N	D
4	4	8	1	5	8	17	6	2	5	2	7

In the mosaic of forest and pastureland around Monteverde, Puntarenas Province, Costa Rica (*ca* 1300 m) it is similarly common throughout the year, as it is even as far north as Florida, U.S.A.

In Costa Rica *E. glabratus* has been collected in the following localities: Alajuela Prov.: Estacion Pitilla at 680 m on NE. side of Volcán Orosi, Finca Campana, 5 km NW. Dos Ríos; Finca San Gabriel, 16 km ENE. Quebrada Grande; 8 km N. Quesada; San Ramón Forest Reserve: Cartago Prov.: Turrialba: Guanacaste Prov.: 19 km S Cañas; Cerro el Hacha; Rincón de la Vieja National Park; Santa Rosa National Park; Volcán Cacao, Estacion Mengo (Finca La Luz); Volcán Orosi, Casa Maritza: Puntarenas Prov.: Monteverde: San José Prov.: San Antonio de Escazú.

E. glabratus is a common endoparasitoid of tree-feeding lymantriid or arctiid larvae. The ichneumonid larva kills its host before the host pupates, and it spins a cocoon within the (usually unbroken) skin of the host larva. R. S. Peigler reared a specimen from an *Orgyia* (Lepidoptera: Lymantriidae) cocoon, but inside the host cocoon I found the caterpillar 'mummy' containing the *Enicospilus* cocoon.

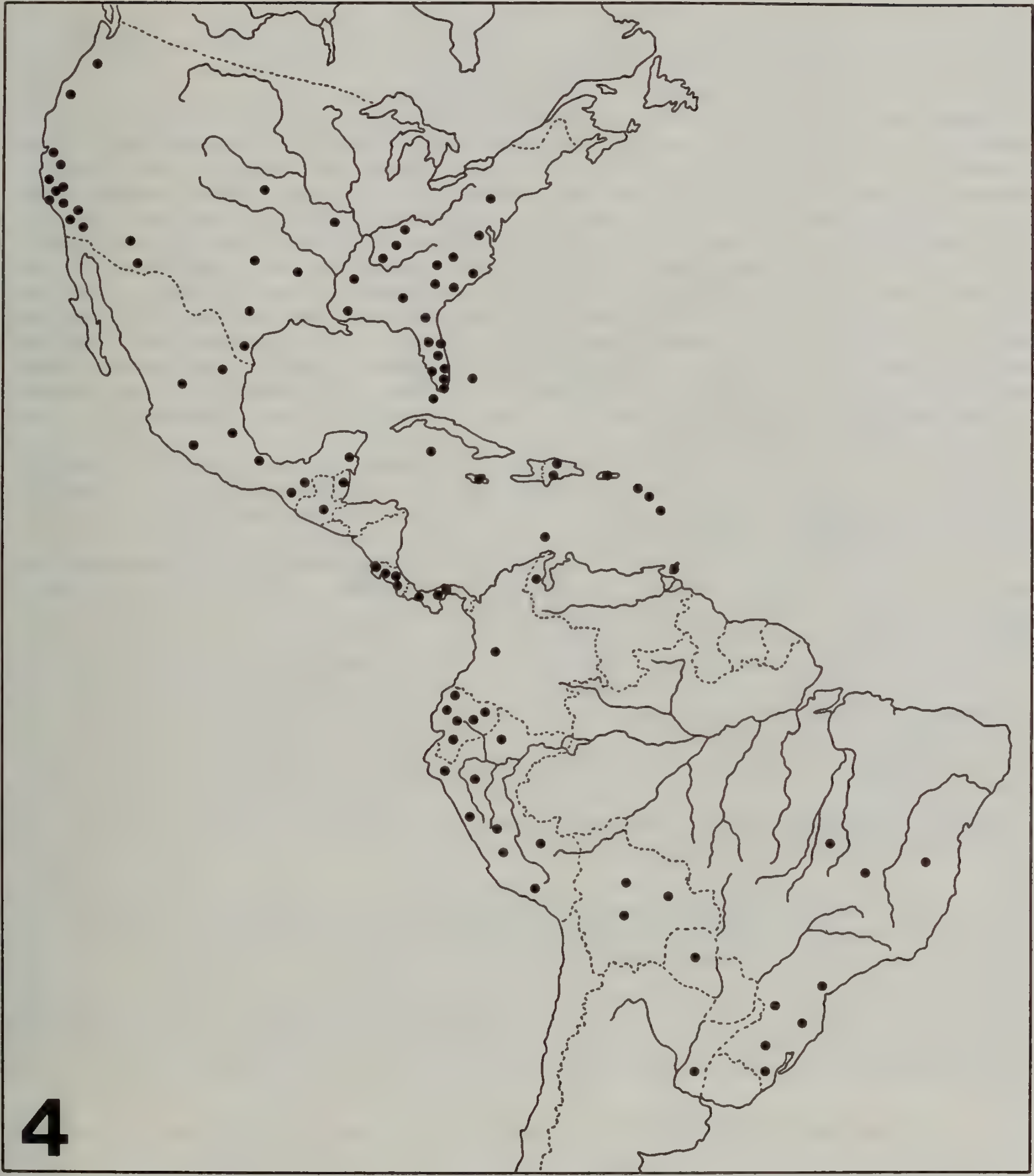
There are numerous rearing records for this species in North America (see summaries in Hooker, 1912; Townes, 1945; Carlson, 1979), but in some cases these records are questionable and probably the ichneumonid was misidentified or confused with *E. americanus*. For example, I have seen no authenticated instances of *E. glabratus* parasitizing Saturniidae. Records of it doing so are probably misidentifications of *E. americanus* or *E. texanus*. In North America I have seen authenticated specimens reared from the following hosts: *Composia* sp., *Diacrisia virginica* (F.), *Lophocampa maculata* (Harris), *Hyphantria cunea* (Drury) (Lepidoptera: Arctiidae); *Dasychira basiflava* (Packard), *Hemerocampa leucostigma* (Abbott & Smith), *Hemerocampa* sp., *Orgyia* sp. (Lepidoptera: Lymantriidae).

Neotropical host information is given by Bruner *et al.* (1945) and Wolcott (1948) who have reared it from the arctiids *Hypercompe albicornis* (Grote) and *H. icasia* (Cramer) respectively. D. H. Janzen has reared this species in Santa Rosa National Park from *Hypercompe suffusa* (Schaus) (Arctiidae) (79-SRNP-96).

Material Examined

Lectotype ♀ (*Eremotylus angulatus* Hooker), **Puerto Rico:** Mayaguez (PANS). Lectotype ♀ (*Eremotylus arctiae* Ashmead), **U.S.A.:** Missouri (USNM). Lectotype ♀ (*Allocamptus cubitalis* Morley), **Mexico**: Guerrero: Chilpancingo, 1500 m (*Smith*) (BMNH)

198 ♂, 214 ♀, from the following: **Argentina** (Entre Ríos, Tucumán); **Bahamas** (Nassau); **Belize**; **Bolivia** (Beni, La Paz); **Brazil** (Bahia, Goias, Guanabara, Paraná, Río Grande do Sul, Santa Catarina); **Colombia** (Valle); **Costa Rica** (Alajuela, Cartago, Guanacaste, Puntarenas and San José Provinces); **Dominican Republic**; **Ecuador** (Azuay, Esmeraldas, Los Ríos, Pichincha); **Grand Cayman**; **Guatemala**; **Jamaica**; **Mexico** (Chiapas, Durango, Guerrero, Nuevo León, Queretaro, Quintana Roo, San Luis Potosí, Veracruz); **Netherlands Antilles** (Saba); **Panama**; **Paraguay** (Cordillera); **Peru** (Huanuco, Junin, Lima, Loreto, Madre de Dios); **Puerto Rico**; **Trinidad**; **U.S.A.** (Alabama, Arizona, Arkansas, California, Florida, Georgia, Indiana, Kansas, Kentucky, Louisiana, Maryland, Missouri, North Carolina, Oklahoma, Oregon, Pennsylvania, South Carolina, Tennessee, Texas, Virginia); **Venezuela** (Zulia); **Virgin Islands**. (BMNH, CAS, CNC, FSCA, PANS, RNH, TC, USNM.)



Map 4 Localities at which *Enicospilus glabratus* has been collected.

Enicospilus alvaroi sp. n.

(Figs 153, 225)

DESCRIPTION. Mandibles proximally very strongly narrowed, distally parallel-sided, extreme apex slightly flared, twisted 20–25°; upper mandibular tooth slightly compressed, 1.2–1.3 times as long as the lower tooth; outer mandibular surface centrally flat, with fine short pubescence, and with a weak proximal concavity. Labrum 0.3 times as long as broad; malar space 0.4 times as long as basal mandibular width. Clypeus in profile flat, margin sharp, not impressed; clypeus in front view 1.6–1.8 times as broad as long, margin truncate. Lower face 0.74–0.81 times as broad as long (broadest in males), smooth and polished with scattered fine punctures. Head of female in dorsal view with genae rounded, that of male slightly buccate; posterior ocellus narrowly separated from eye; FI = 64–70%; occipital carina mediodorsally obsolescent, ventrally curved to approach and join hypostomal carina. Antenna moderately long, with 53 flagellar segments; 20th segment 1.7–1.8 times as long as broad.

Mesoscutum weakly polished, finely granulate with scattered punctures, in profile abruptly rounded; notauli weak but discernible and extending back to level of hind margin of tegula. Mesopleuron polished, the upper part finely punctate, the lower part with the punctures coalescing to give punctostriations; epicnemial carina inclined towards anterior margin of pleuron, its lower corner slightly produced, rather acute. Scutellum in profile weakly convex, laterally carinate for 0.9+ of its length; scutellum in dorsal view 1.6–1.7 times as long as anteriorly broad, granulate, posteriorly wrinkled. Metapleuron weakly convex, but with ventral part flattened, polished, finely and evenly punctate but with fine reticulation between punctures; submetapleural carina weakly broadened anteriorly; posterior transverse carina of mesosternum complete. Propodeum in profile abruptly declivous; anterior transverse carina strong, complete, posterior one also strong and complete, paralleling the anterior one (Fig. 153); anterior area short and steeply declivous, without sculpture or with isolated striae; spiracular area short and almost smooth; posterior area with irregular rugae, the part behind the posterior transverse carina with the rugae radiating from the gastral insertion; lateral longitudinal carina present anteriorly, and near posterior end, not joined to spiracular margin by a short carina.

Fore wing length 19–20 mm; discosubmarginal cell as in Fig. 225; AI = 1.25–1.36; CI = 0.49–0.54; ICI = 0.70–0.74; SDI = 1.38–1.47; *cu-a* virtually opposite the base of *Rs&M*; marginal cell proximally evenly hirsute; 1st subdiscal cell with anterior 0.6 hirsute. Hind wing with 8–10 hamuli on *R*1; 1st abscissa of *Rs* straight, 2nd abscissa arcuate.

Fore leg with tibia slightly flattened, with scattered spines on outer surface. Mid leg with longer tibial spur 1.3–1.4 times length of the shorter. Hind leg with coxa in profile 1.7–1.8 times as long as deep; trochantellus dorsally <0.1 times as long as broad; 4th segment of tarsus 1.9 times as long as broad; claws of female finely and closely pectinate, those of male similar.

Gaster rather short and stout; tergite 2 in profile 2.1–2.3 times as long as posteriorly deep, laterotergite folded under, thyridia subcircular and separated from anterior margin of tergite by about 1.5–2.0 times its own length. Ovipositor slender, its sheath narrow. Male with sternites 7–9 bearing numerous long stout erect hairs; gonosquama apically acute.

Colour generally yellowish brown, thorax covered with dense yellowish pubescence; gaster slightly infuscate; interocellar area yellowish; antenna yellowish; pterostigma golden; wings weakly infumate.

VARIATION. This species is unusual in having a sexually dimorphic head; that of the male is more swollen behind the eyes than is that of the female.

REMARKS. This species is named after Alvaro Espinosa of Cuajiniquil, who has faithfully tended the Malaise traps, sorted Hymenoptera and reared caterpillars for years in Santa Rosa National Park.

Enicospilus alvaroi is immediately recognizable because it is the only species with the two propodeal transverse carinae equally well developed and parallel. This stout species is quite similar to *E. bozai*. The two are both unusually stout and have a short deep tergite 2, an acute gonosquama and a centrally evanescent occipital carina. *E. alvaroi* differs from *E. bozai* not only in the form of the propodeum, but also in having a smaller ICI, a more polished and flatter metapleuron, and a slightly sinuous *Rs+2r*. The pubescence on the terminal gastral sternites of the male of *E. bozai* is denser and shorter than that of *E. alvaroi*.

BIOLOGICAL INFORMATION. This species has only been collected in Guanacaste Province, northern Costa Rica.

MATERIAL EXAMINED

Holotype ♀, **Costa Rica**: Guanacaste Prov., 4 km E. of Casetilla, Rincón National Park, iv.1985 (*Janzen & Hallwachs*) (BMNH).

Paratypes. **Costa Rica**: Guanacaste Prov.: 1 ♂, 1 ♀, Santa Rosa National Park, 300 m, vii.1980 and vi.1984 (*Janzen & Hallwachs*) (BMNH).

Enicospilus mayi sp. n.

(Figs 90, 155, 227)

DESCRIPTION. Mandibles quite long, proximally strongly tapered, distally parallel-sided, apically twisted 25–35°; upper mandibular tooth compressed, 1.4–1.6 times as long as the lower tooth; outer mandibular surface weakly concave centrally, bearing close fine hairs, and with an elongate shallow proximal concavity. Labrum 0.2 times as long as broad; malar space 0.3 times as long as basal mandibular width. Clypeus in profile flat, margin blunt to subacute; clypeus in front view 1.3–1.4 times as broad as long, with margin truncate. Lower face 0.69–0.77 times as broad as long, polished, sparsely and finely punctate. Head in dorsal view with genae evenly constricted; posterior ocellus contiguous with eye; FI = 70–75%; occipital carina mediodorsally complete, ventrally curved to join hypostomal carina but with lower end evanescent. Antenna long and slender, with 66–69 flagellar segments; 20th segment 1.6–1.8 times as long as broad.

Mesoscutum, weakly polished, granulate, in profile steeply rounded; notauli vestigial. Mesopleuron weakly polished, the upper part punctate with microreticulation between punctures, the lower part with punctures more superficial and with some irregular rugosities; epicnemial carina inclined towards anterior margin of pleuron, its upper end evanescent. Scutellum in profile moderately convex, laterally carinate for 0.8+ of its length; scutellum in dorsal view 1.6–1.7 times as long as anteriorly broad, polished with superficial punctures. Metapleuron very convex, granulate; submetapleural carina evenly anteriorly broadened; posterior transverse carina of mesosternum complete, medioventrally angled forwards so there is a distinct V-shaped emargination centrally, and with lateral extremities abruptly angled so quite sharp corners protrude. Propodeum in profile abruptly declivous; anterior transverse carina complete or lateromedially weak, posterior transverse carina present as lateral crests; anterior area short, steeply declivous, smooth or with isolated striae; spiracular area short and granulate, posterior area coarsely rugose, often with rugae tending to be concentric posteriorly; lateral longitudinal carina present anteriorly, not joined to spiracular margin by a short carina.

Fore wing length 20–22 mm; discosubmarginal cell as in Fig. 227; AI = 0.84–1.23; CI = 0.48–0.65; ICI = 1.44–1.60; SDI = 1.35–1.45; *cu-a* from subopposite *Rs&M* to slightly proximal to it; marginal cell proximally evenly hirsute; 1st subdiscal cell with anterior 0.6 hirsute. Hind wing with 7–9 hamuli on *R*1; 1st abscissa of *Rs* straight, 2nd abscissa weakly arcuate.

Fore leg with tibia moderately flattened, with many scattered spines on outer surface. Mid leg with longer tibial spur 1.3–1.5 times length of the shorter. Hind leg with coxa in profile 1.6–1.7 times as long as deep; trochantellus dorsally <0.1 times as long as broad; 4th segment of tarsus 2.6–2.7 times as long as broad; claws of female large, with numerous close, moderately long pectinae, those of male similar but with pectinae a little closer and flatter.

Gaster long and slender; tergite 2 in profile 3.0–3.5 times as long as posteriorly deep, laterotergite pendant, thyridia elliptical and separated from anterior margin of tergite by 2 or more times its own length. Ovipositor slender, its sheath narrow. Male with sternites 7–9 bearing fine decumbent hair (Fig. 155); gonosquama long, obliquely truncate.

Colour generally dark yellowish brown with head paler yellowish, median mesoscutal stripe blackish; interocellar area yellow; antenna black, at least basally, distally often brownish; pterostigma dark brown; wings weakly infumate.

VARIATION. Costa Rican specimens have the flagellum shining bluish black but those of the Panamanian ones are dark brownish, and only black basally. One Panamanian individual is smaller (fore wing length 14 mm), paler and less strongly sculptured, but otherwise structurally similar.

REMARKS. This species is named in honour of Mr Philip May, a major supporter of the growth and development of the proposed Guanacaste National Park.

Enicospilus mayi is distinctive on account of its small fenestra, pendant laterotergite 2, complete 'notched' posterior transverse carina of the mesosternum and large SDI. It is apparently closely related to *E. chiriquensis*, but it is larger and more slender.

BIOLOGICAL INFORMATION. *Enicospilus mayi* is only known to occur in Costa Rica and Panama. It is relatively uncommon and has been collected in several wet forest sites at altitudes between 100 and 750 m. A single female has been collected in Santa Rosa National Park in May, at the start of the wet season.

MATERIAL EXAMINED

Holotype ♂, **Costa Rica**: Alajuela Prov., Finca Campana, 5 km NW. Dos Ríos, 750 m, iii.1985 (*Janzen & Hallwachs*) (BMNH).

Paratypes. **Costa Rica**: Alajuela Prov.: 1 ♂, Finca Campana, 5 km NW. Dos Ríos, 750 m, iii.1985 (*Janzen & Hallwachs*) (BMNH); 1 ♂, Finca San Gabriel, 700 m, v.1984 (*Janzen & Hallwachs*) (BMNH); 1 ♂, 3 ♀, same locality, 750 m, vi.1986 (*Gauld*) (BMNH): Guanacaste Prov.: 1 ♀, Santa Rosa National Park, 300 m, v.1983 (*Janzen & Hallwachs*) (BMNH): San José Prov.: 1 ♀, Estacion Carrillo, Braulio Carrillo National Park, 700 m, v.1985 (*Chacon*) (BMNH). **Panama**: 1 ♂, Barro Colorado Island, vii.1963 (*Cavagnaro & Irwin*) (CAS); 3 ♂, 5 ♀, same locality, i-ii, iv-vii.1978 (*Wolda*) (RNH); 1 ♀, same locality, ix.1984 (*Wolda*) (BMNH); 1 ♀, Boquete, Alto Lino, 1300 m, i.1978 (*Wolda*) (RNH); 1 ♀, Cerro Campana, nr Chica, v.1965 (*Duckworth & Duckworth*) (USNM).

Enicospilus chiriquensis (Cameron)

(Figs 91, 154, 156, 226)

Ophion chiriquensis Cameron, 1886: 294. Holotype ♀, PANAMA (BMNH) [examined].
[*Allocamptus stramineus* (Taschenberg) Morley, 1912: 21, in part. Misidentification.]
Eurycamptus calcator Morley, 1912: 29. Holotype ♂, BRAZIL (BMNH) [examined]. **Syn. n.**
Enicospilus calcator (Morley) Townes & Townes, 1966: 175.
Enicospilus chiriquensis (Cameron) Townes & Townes, 1966: 176.

DESCRIPTION. Mandibles from quite short to moderately long, proximally strongly tapered, distally parallel-sided, apically twisted 10–25°; upper mandibular tooth compressed, quite stout, 1.4–1.6 times as long as the lower tooth; outer mandibular surface weakly concave, finely pubescent, with an elongate shallow proximal concavity that is usually finely granulate. Labrum 0.2–0.3 times as long as broad; malar space 0.3–0.4 times as long as basal mandibular width. Clypeus in profile flat, margin blunt to subacute; clypeus in front view 1.3–1.7 times as broad as long, with margin truncate. Lower face 0.65–0.77 times as broad as long, polished, sparsely and finely punctate. Head in dorsal view with genae evenly constricted; posterior ocellus contiguous with eye; FI = 65–75%; occipital carina mediodorsally complete, rarely slightly evanescent, ventrally abruptly curved to approach hypostomal carina, but with lower end evanescent. Antenna moderately long and slender, with 52–60 flagellar segments; 20th segment 1.5–1.8 times as long as broad.

Mesoscutum weakly polished, shallowly punctate with fine granulation, in profile abruptly rounded; notauli vestigial. Mesopleuron weakly polished, the upper part punctate to punctostriate, the lower part punctostriate, often with some granulation; epicnemial carina inclined towards anterior margin of pleuron, its upper end curved, evanescent. Scutellum in profile weakly convex, laterally carinate for 0.7+ of its length; scutellum in dorsal view 1.5–1.6 times as long as anteriorly broad, granulate. Metapleuron moderately convex, matt, granulate to striate; submetapleural carina evenly anteriorly broadened; posterior transverse carina of mesosternum centrally absent. Propodeum in profile abruptly declivous; anterior transverse carina complete or lateromedially weak, posterior transverse carina present as lateral crests, sometimes almost complete, but always medially interrupted; anterior area short, steeply declivous, usually smooth; spiracular area short, from smooth to granulate; posterior area coarsely rugose, often with rugae tending to be concentric posteriorly (Fig. 154); lateral longitudinal carina present anteriorly, not joined to spiracular margin by a short carina.

Fore wing length 16–18 mm; discosubmarginal cell as in Fig. 226; AI = 1.12–1.31; CI = 0.47–0.80; ICI = 0.97–1.55; SDI = 1.38–1.45; *cu-a* from subopposite *Rs&M* to slightly proximal to it; marginal cell proximally evenly hirsute; 1st subdiscal cell with anterior 0.6 hirsute. Hind wing with 6–10 hamuli on *R*1; 1st abscissa of *Rs* straight, 2nd abscissa weakly arcuate.

Fore leg with tibia weakly to moderately flattened, with many scattered spines on outer surface. Mid leg with longer tibial spur 1.3–1.5 times length of the shorter. Hind leg with coxa in profile 1.5–1.7 times as long as deep; trochantellus dorsally <0.1 times as long as broad; 4th segment of tarsus 2.1–2.7 times as long as broad; claws of female large, with numerous close moderately long pectinae, those of male similar but with pectinae a little closer and flatter.

Gaster moderately stout; tergite 2 in profile 2.4–4.0 times as long as posteriorly deep, laterotergite narrow, membranous, usually pendant, but rarely upturned; thyridia oval to elliptical and separated from anterior margin of tergite by 2–3 times its own length. Ovipositor slender, its sheath moderately narrow. Male with sternites 7–9 bearing long stout erect dense hair (Fig. 156); gonosquama rounded.

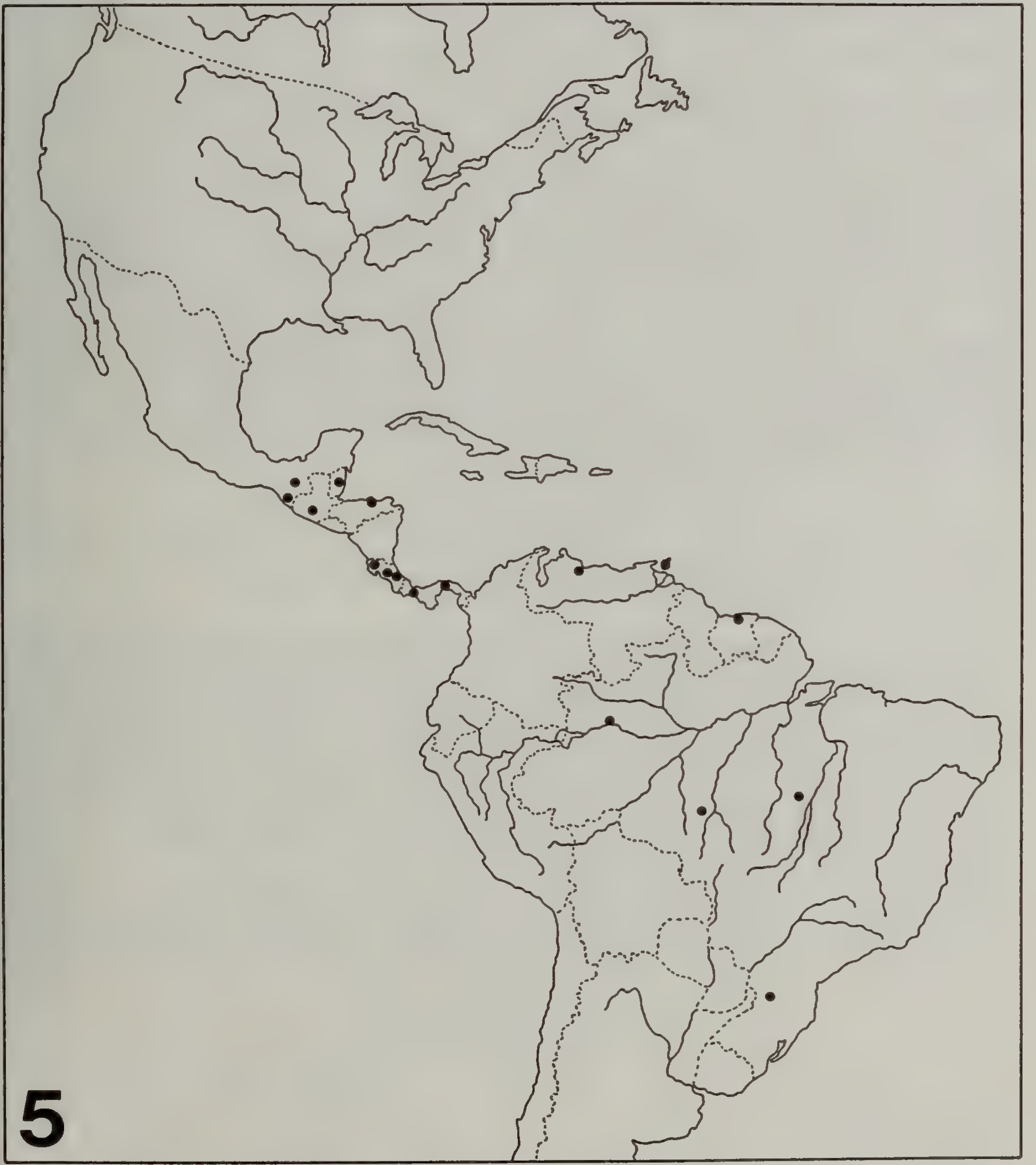
Colour generally yellowish brown often with tergite 3+ blackish, usually with darker vittae discernible on the mesoscutum; interocellar area yellow; antenna usually medium brown; pterostigma brown; wings weakly infumate.

VARIATION. A few specimens are uniformly sandy brown; a number of these have the second laterotergites folded under. Furthermore, they always have the lateral extremity of the posterior transverse carina of the mesosternum angulate. These may represent a distinct species, but some individuals seem to be intermediate. One specimen from Santa Rosa has *Rs+2r* very much more strongly sinuate than that of any other individual, but is otherwise a typical example of this species. Two specimens from Barro Colorado Island, Panama (RNH) and Finca San Gabriel, Costa Rica (BMNH) have a distinct comma-shaped proximal sclerite present in the fore wing. In other respects they are similar to typical specimens, and as the alar sclerite occurs in a homologous position as a weak thickening in the wings of other specimens it is assumed these individuals are conspecific.

REMARKS. *Enicospilus chiriquensis* is distinctive on account of its small fenestra, centrally incomplete posterior transverse carina of the mesosternum and large ICI. It is apparently closely related to *E. mayi* but it is altogether smaller and stouter.

Biological Information. *Enicospilus chiriquensis* is a widespread Neotropical species whose range extends from Chiapas, southern Mexico, south to northern Brazil (Map 5). It is primarily a lowland species and I have not known it to be taken above 1100 m in Costa Rica, though the holotype is purported to come from a higher altitude in Panama. *E. chiriquensis* seems to be most common in wet forests, though it does occur in seasonally dry habitats during the driest months of the year. Specimens from Santa Rosa National Park have been collected between November and June (pooled data for 1982–4):

J	F	M	A	M	J	J	A	S	O	N	D
3	2	1	1	1	1	–	–	–	–	1	–



Map 5 Localities at which *Enicospilus chiriquensis* has been collected.

The largest single group of specimens (7) was collected one night in March (dry season) at Finca Campana, 5 km NW. Dos Ríos, Alajuela Prov. On Barro Colorado Island, Panama, this species has been recorded during the following months (cumulative totals, 1978, 1983–5):

J	F	M	A	M	J	J	A	S	O	N	D
1	8	2	4	1	9	3	1	2	–	1	2

A specimen in the USMN is purported to have been reared from *Hylesia* sp. (Lepidoptera: Saturniidae).

MATERIAL EXAMINED

Holotype ♂ (*Eurycamptus calcator* Morley), **Brazil**: Ega (= Tefé) on the Amazon (*Bates*) (BMNH). Holotype ♀ (*Ophion chiriquensis* Cameron), **Panama**: Volcán de Chiriqui, 1700–2000 m (BMNH).

Belize: 1 ♀, Toledo, Columbia Forest Station, vii.1968 (*Hasse*) (BMNH). **Brazil**: 1 ♀, Nova Teutonia, Santa Catarina, xii.1952 (*Plaumann*) (TC); Mato Grosso; 1 ♂, Sinop, 12°31'S 55°37'W, x.1975 (*Alvarenga*) (TC); 1 ♀, dry forest, 12°50'S 51°47'W, ix.1938 (*Richards*) (BMNH). **Costa Rica**: Alajuela Prov.: 3 ♂, 4 ♀, Finca Campana, 5 km NW. Dos Ríos, 750 m, iii.1985 (*Janzen & Hallwachs*) (BMNH); 1 ♀, Finca San Gabriel, 3 km W. Dos Ríos, 850 m, vi.1986 (*Gauld*) (BMNH): Guanacaste Prov.: 1 ♀, Rincón de la Vieja, 900 m, iii.1984 (*Gauld*) (BMNH); 2 ♂, 8 ♀, Santa Rosa National Park, 300 m, xi.1981, i-ii.1982, ii,iv-v.1983, iii & vi.1984 (*Janzen & Hallwachs*) (BMNH); 1 ♀, Volcán Cacao, Estacion Mengo on SW. side, 1100 m, vi.1987 (*Janzen*) (BMNH); 1 ♀, Volcán Orosi, Casa Mariksa [Maritza], 700 m, vii.1986 (*Gauld*) (BMNH): Heredia Prov.: 2 ♀, Puerto Viejo de Sarapiqui, Finca La Selva, xi.1986 (*Janzen & Hallwachs*) (BMNH): Limón Prov.: 2 ♂, 1 ♀, Cerro Tortuguero, N. edge Tortuguero National Park, 0–100 m, v.1984 (*Janzen & Hallwachs*) (BMNH). **Guatemala**: 1 ♀, Cayuga, iv.1915 (*Cush*) (USNM). **Honduras**: 1 ♀, Trujillo, vii.1968 (*Dozier*) (FSCA). **Mexico**: Chiapas: 1 ♀, 32 km N. Huixtla, 1000 m, vi.1969 (CNC); 1 ♀, Palenque, viii.1969, (*Kelton*) (CNC). **Panama**: 2 ♀, Barro Colorado Island, vii.1963 (*Cavagnaro & Irwin*) (CAS); 1 ♀, same locality, iv.1965 (*Duckworth & Duckworth*) (USNM); 1 ♀, same locality, x-xi.1941 (*Zetek*) (USNM); 4 ♀, same locality, iv, vi, vii, xi.1978 (*Wolda*) (RNH); 1 o, 2 ♀, Barro Colorado Island, Gatun Lake, iv.1979 & i-iv.1983 (*Wolda*) (TC); 1 ♂, 15 ♀, Barro Colorado Island, i-ix, xii. 1984–5 (*Wolda*) (BMNH); 1 ♀, Canal Zone, ex *Hylesia* sp. (*Dunn*) (USNM); 1 ♀, Trinidad River, vi.1912 (*Busck*) (USNM). **Surinam**: 1 ♀, Paramaribo, v.1944 (*Geijskes*) (RNH). **Venezuela**: 1 ♀, San Esteban, nr Puerto Cabello, i.1940 (*Anduze*) (TC).

Enicospilus brevis (Morley)

(Figs 158, 229)

Allocamptus brevis Morley, 1912: 24. Holotype ♀, BRAZIL (BMNH) [examined].
Enicospilus brevis (Morley) Townes & Townes, 1966: 174.

DESCRIPTION. Mandibles moderately short, proximally strongly narrowed, distally weakly narrowed, apically twisted 45–60° (Fig. 158); upper mandibular tooth compressed, quite stout, 1.2–1.4 times as long as the lower tooth; outer mandibular surface flat, shortly and sparsely hirsute, with a weak proximal concavity. Labrum 0.3–0.4 times as long as broad; malar space 0.3–0.4 times as long as basal mandibular width. Clypeus in profile flat, margin sharp; clypeus in front view 1.5–1.7 times as broad as long, margin truncate apically. Lower face 0.76–0.91 times as broad as long, polished, finely punctate. Head in dorsal view with genae evenly rounded; posterior ocellus more or less contiguous with eye; FI = 70–75%; occipital carina mediodorsally generally centrally interrupted, rarely complete, ventrally abruptly curved to join hypostomal carina but with lower end evanescent. Antenna moderately long, with (44) 51–56 flagellar segments; 20th segment 1.7–2.0 times as long as broad.

Mesoscutum weakly polished, finely coriaceous, in profile abruptly rounded; notauli vestigial. Mesopleuron polished, the upper part punctate, the lower part punctostriate; epicnemial carina inclined towards anterior margin of pleuron, its upper end evanescent. Scutellum in profile weakly convex, laterally carinate for all of its length; scutellum in dorsal view 1.3–1.4 times as long as anteriorly broad, smooth, with isolated punctures and posteriorly with a few irregular wrinkles. Metapleuron quite strongly convex, weakly to quite strongly polished, finely punctate or punctogranulate, grading to weakly striate posterodorsally; submetapleural carina weakly anteriorly broadened; posterior transverse carina of mesosternum usually centrally interrupted, if complete then centrally rather weak. Propodeum in profile abruptly declivous; anterior transverse carina from complete to present only as a central vestige, or in the holotype, completely absent; posterior transverse carina absent; anterior area moderately long, at most weakly wrinkled; spiracular area short, smooth; posterior area generally rather weakly wrinkled, often almost smooth, if more coarsely sculptured then wrinkles tend to be subconcentric posteriorly; lateral longitudinal carina usually entirely absent, not joined to spiracular margin by a short carina.

Fore wing length usually 17–20 mm, though sometimes as little as 11 mm; discosubmarginal cell as in Fig. 229; AI = 0.79–1.07; CI = (0.39) 0.73–0.95; ICI = 0.35–0.78; SDI = 1.23–1.62; *cu-a* from subopposite to *Rs&M* to proximal to it by 0.3 times its own length; marginal cell proximally more or less evenly hirsute; 1st subdiscal cell with anterior 0.2–0.4 and posterodistal corner hirsute. Hind wing with 5–9 hamuli on *R*1; 1st abscissa of *Rs* more or less straight, 2nd abscissa weakly arcuate.

Fore leg with tibia slightly flattened, with scattered fine spines on outer surface. Mid leg with longer tibial spur 1.3–1.4 times length of the shorter. Hind leg with coxa in profile 1.6–1.7 times as long as deep; trochantellus dorsally <0.1 times as long as broad; 4th segment of tarsus 2.3–2.7 times as long as broad; claws of female with moderately long, close pectinae, those of male similar.

Gaster slender; tergite 2 in profile 4.0–4.5 times as long as posteriorly deep, laterotergite generally folded under though it may be partially pendant in some individuals, thyridia elliptical and separated from anterior margin of tergite by about 2.5–3.5 times its own length. Ovipositor slender, its sheath moderately stout. Male with sternites 7–9 bearing scattered fine erect hairs amongst short decumbent pubescence; gonosquama strongly distally tapered, but terminally rounded.

Colour generally rather pale brownish yellow with mesoscutal vittae darker brown, the central one often blackish; interocellar area yellowish brown; antenna orange-brown, often infuscate distally; pterostigma orange-brown; wings weakly infumate.

VARIATION. Some specimens have tergites 3+ weakly infuscate to blackish and in one of these the anterior gastral segments have a distinct greenish hue. The holotype and a male from Corcovado National Park are unusually small (fore wing lengths 11 and 13 mm respectively) and have only 44 flagellar segments. The antennae of the Corcovado specimen and several others are black. One individual from Braulio Carrillo National Park, Costa Rica is unusual in having CI very small, but in the form of the mandibles and the sculpture of the propodeum it is a typical example of this species.

REMARKS. *Enicospilus brevis* is most easily recognized by the possession of two very unusual features – having the mandibles strongly twisted and tapered right to the end, and (usually) having the cubital index (CI) exceptionally large. The majority of specimens are also distinctive in having the propodeal sculpture very weak, and in frequently having the anterior transverse carina discontinuous. The characteristic pubescence of the terminal male sternites and the convex metapleuron are features that *E. brevis* shares with *E. robertoi* and *E. scuintlei* and the three species are probably closely related.

BIOLOGICAL INFORMATION. *Enicospilus brevis* is a widely distributed species whose range extends from Costa Rica south to southern Brazil (Map 6). It has been collected in sites from near sea-level up to 2400 m in Bolivia. In Central America this species is associated with wet forests from sea-level up to an altitude of about 1400 m. It has never been found in dry forests of north-western Guanacaste.

MATERIAL EXAMINED

Holotype ♀, **Brazil**: Villa Nova on the Amazon (*Bates*) (BMNH).

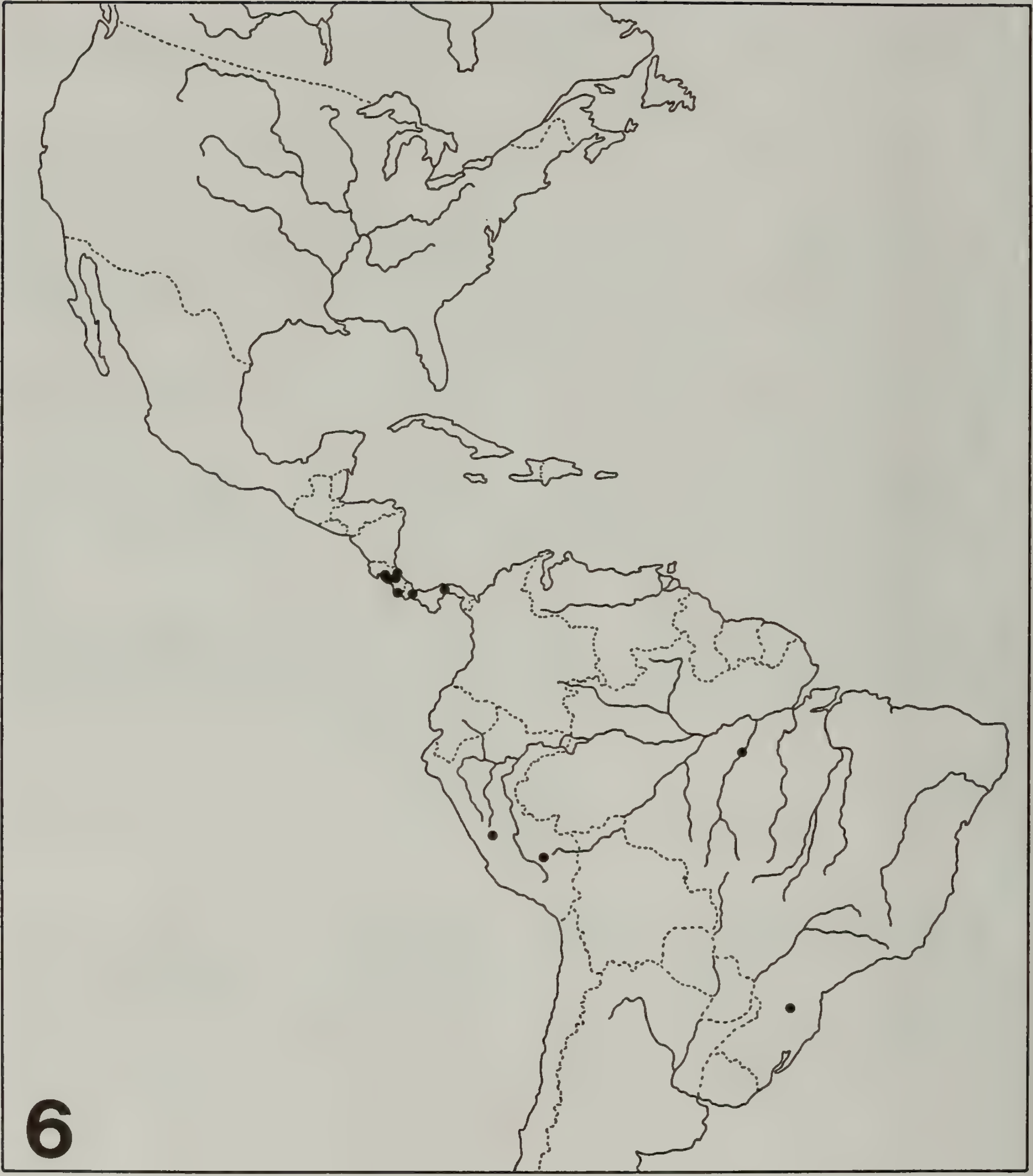
Non-type material. **Bolivia**: 1 ♂, Yungas, 2400 m, xii.1984 (Peña) (TC). Brazil: 1 ♂, 1 ♀, Santa Catarina, Nova Teutonia, 27°11'S, 52°23'W, x.1935 & ii.1939 (*Plaumann*) (BMNH). **Costa Rica**: Alajuela Prov.: 1 ♂, 1 ♀, Finca San Gabriel, 16 km ENE. of Quebrada Grande, 650 m, iii.1983 & v.1984 (*Janzen & Hallwachs*) (BMNH); 4 ♂, San Ramón Reserve, Río San Lorencito, 800 m, ii-iii.1987 (*Chacon*) (BMNH); 1 ♂, 1 ♀, Virgen de Socorro, 800 m, ii.1987 (*Janzen & Hallwachs*) (BMNH): Heredia Prov.: 1 ♀, Puerto Viejo de Sarapiqui, Finca La Selva, iv.1986 (BMNH): Puntarenas Prov.: 1 ♀, 1 ♂, Corcovado National Park, 20 m, v.1984 (*Gauld*) (BMNH); 1 ♂, Monteverde, 1300–1400 m, vii.1982 (*Janzen & Hallwachs*) (BMNH); 1 ♀, same locality, iv-v.1984 (*Gauld*) (BMNH); 2 ♂, same locality, xi.1985 & i.1986 (*Haber*) (BMNH): San José Prov.: 2 ♀, Estacion Carrillo, Braulio Carrillo National Park, 700 m, iii & v.1985 (*Chacon & Chacon*) (BMNH). **Panama**: 1 ♂, 1 ♀, Barro Colorado Island, iv.1965 (*Duckworth & Duckworth*) (USNM); 2 ♀, same locality, x.1977, iv.1978 (*Wolda*) (RNH); 2 ♂, 5 ♀, Chiriqui, Fortuna, 1050 m, i-v, x.1978 (*Wolda*) (RNH); 1 ♀, Las Cumbres, vi.1984 (*Wolda*) (BMNH). **Peru**: 1 ♀, Divisoria, Huanuco, 1700 m, ix.1946 (*Woytkowski*) (TC); 1 ♂, Machu Picchu, xi.1965, (*Townes & Townes*) (TC).

Enicospilus robertoi sp. n.

(Figs 157, 228)

Enicospilus species; Janzen, 1984b: 509.

DESCRIPTION. Mandibles evenly tapered, apically twisted 10–15° (Fig. 157); upper mandibular tooth slightly compressed, 1.2–1.3 times as long as the lower tooth; outer mandibular surface centrally flat, proximally with a shallow concavity. Labrum 0.3 times as long as broad; malar space 0.3–0.4 times as long as basal mandibular width. Clypeus in profile weakly convex, margin blunt to subacute; clypeus in front



Map 6 Localities at which *Enicospilus brevis* has been collected.

view 1.3–1.4 times as broad as long, margin truncate. Lower face 0.68–0.74 times as broad as long, polished, punctate, sometimes tending to punctostriate centrally. Head in dorsal view with genae evenly rounded posteriorly; posterior ocellus virtually touching eye; FI = 75–80%; occipital carina mediodorsally slightly flattened, often weak, sometimes interrupted, ventrally curved to join hypostomal carina but with lower end evanescent. Antenna long and slender, with 54–57 flagellar segments; 20th segment 1.9–2.0 times as long as broad.

Mesoscutum polished, puncto-granulate, in profile quite steeply rounded; notauli weak, shallow. Mesopleuron polished, the upper part superficially punctostriate, the lower part coarsely and closely punctostriate; epicnemial carina inclined towards anterior margin of pleuron, its upper end curved, rather evanescent. Scutellum in profile moderately convex, laterally carinate for 0.9+ of its length; scutellum in dorsal view 1.5–1.6 times as long as anteriorly broad, finely granulate, posteriorly rugose to wrinkled. Metapleuron strongly convex, diagonally striate, polished; submetapleural carina evenly anteriorly broadened; posterior transverse carina of mesosternum complete, strong, often slightly raised centrally. Propodeum in profile evenly declivous; anterior transverse carina complete, weak, posterior transverse carina indistinct, usually absent; anterior area moderately long, steeply declivous, sparsely striate; spiracular area short, granulate; posterior area strongly coarsely concentrically striate; lateral longitudinal carina present only anteriorly, not joined to spiracular margin by a short carina.

Fore wing length 14–17 mm; discosubmarginal cell as in Fig. 228; AI= 0.75–1.20; CI = 0.37–0.55; ICI = 0.42–0.56; SDI = 1.16–1.27; *cu-a* subopposite or slightly proximal to base of *Rs&M*; marginal cell proximally evenly hirsute; 1st subdiscal cell with anterior 0.6 sparsely hirsute. Hind wing with 7–8 hamuli on *R*1; 1st abscissa of *Rs* straight, 2nd abscissa weakly arcuate.

Fore leg with tibia subcylindrical to weakly flattened, with scattered spines on outer surface. Mid leg with longer tibial spur 1.3–1.5 times length of the shorter. Hind leg with coxa in profile 1.6–1.7 times as long as deep; trochantellus dorsally not exposed centrally; 4th segment of tarsus 2.5–2.7 times as long as broad; claws of female large, with long stout pectinae, those of male similar but with pectinae much shorter.

Gaster long and slender; tergite 2 in profile 4.0–5.0 times as long as posteriorly deep, laterotergite upturned, thyridia elliptical and separated from anterior margin of tergite by about 3–5 times its own length. Ovipositor slender, its sheath narrow. Male with sternites 7–9 bearing very sparse, long fine erect hairs amid fine decumbent pubescence; gonosquama evenly rounded.

Colour generally pale yellowish, tergites 3+ infuscate, mesoscutum slightly infuscate; interocellar area yellow; antenna yellowish; pterostigma yellowish; wings hyaline.

VARIATION. Smaller specimens tend to be very pale yellow in general colour.

REMARKS. This species is named in honour of Roberto Espinoza of Cuajiniquil, who has faithfully tended the Malaise traps, sorted Hymenoptera and reared caterpillars for years in Santa Rosa National Park.

Enicospilus robertoi closely resembles *E. scuintlei* in structure and colour, but differs in having *Rs+2r* more evenly bowed and possessing a larger oval-triangular sclerite in the fenestra. The similarity between *E. robertoi* and *E. scuintlei* in the form of the mandibles and metapleurae, the male subgenital plate and colour suggest they are sister-species.

BIOLOGICAL INFORMATION. *Enicospilus robertoi* is a Mesoamerican species that occurs from Belize south to Costa Rica. It has been collected in lowland and lower montane forest up to an altitude of about 1400 m. In Santa Rosa National Park, Costa Rica, it appears to fly at the beginning and end of the wet season (pooled data for 1979–84):

J	F	M	A	M	J	J	A	S	O	N	D
2	1	–	–	1	2	4	–	–	–	–	8

At Monteverde, Puntarenas Province, Costa Rica, it has only been encountered between January and May (all data pooled):

J	F	M	A	M	J	J	A	S	O	N	D
8	14	7	1	4	–	–	–	–	–	–	–

E. robertoi is a larval endoparasitoid of *Hylesia lineata* Druce (Lepidoptera: Saturniidae). This small, polyphagous hemileucine saturniid has urticating larvae which live gregariously up to the third instar. It is not known what instar larvae are parasitized, but *E. robertoi* has emerged from mature larvae that had been collected during their 4th instar. In Santa Rosa National Park *H. lineata* usually has two generations a year (Janzen, 1984b)

Rearing data: 79-SRNP-55C; 79-SRNP-315; 79-SRNP-345; 79-SRNP-55H.

MATERIAL EXAMINED

Holotype ♂, **Costa Rica**: Guanacaste Prov., Santa Rosa National Park, ex *Hylesia lineata*, 1979 (*Janzen & Hallwachs*) (BMNH).

Paratypes. **Belize**: 1 ♀, Middlesex, 125 m, v.1963 (*Welling*) (CNC). **Costa Rica**: Alajuela Prov.: 2 ♀, Finca Campana, 5 km NW. Dos Ríos, 750 m, iii.1985 (*Janzen & Hallwachs*) (BMNH); Guanacaste Prov.: 4 ♀, Volcán Cacao, Finca La Luz [Estacion Mengo], 1100 m, viii.1986, i,iii.1987 (*Janzen & Hallwachs*) (BMNH); 1 ♀, Volcán Orosi, Casa Mariksa [Maritza], 700 m, i.1986 (*Janzen & Hallwachs*) (BMNH); 3 ♀, same locality, 700 m, vii.1986 (*Gauld*) (BMNH); 5 ♂, 6 ♀, Santa Rosa National Park, 300 m, i, vi, vii & xii.1979 (*Janzen*) (TC); 7 ♀, same locality, v & vii.1980, ii.1984, iii.1985 & i.1986 (*Janzen & Hallwachs*) (BMNH); 1 ♀, same locality, SE. of Entrada, vi.1986 (*Godfrey*) (BMNH): Puntarenas Prov.: 1 ♀, Monteverde, 1300 m, ii.1967 (*Palmer*) (TC); 1 ♀, same locality, ii.1980 (*Mason*) (TC); 1 ♀, same locality, iv.1984 (*Gauld*) (BMNH); 1 ♀, same locality, v.1980 (*Janzen & Hallwachs*) (BMNH); 2 ♂, 14 ♀, same locality, i-iii, v.1986 (*Haber*) (BMNH); 14 ♀, same locality, i-iii.1986 (*Forsyth*) (CNC).

Enicospilus scuintlei sp. n.

(Fig. 230)

DESCRIPTION. Mandibles moderately long, relatively slender, apically twisted 10–30°; upper mandibular tooth slightly compressed, 1.7–2.0 times as long as the lower tooth; outer mandibular surface flat, proximal concavity moderately deep. Labrum 0.2–0.3 times as long as broad; malar space 0.2–0.3 times as long as basal mandibular width. Clypeus in profile almost flat, margin quite sharp; clypeus in front 1.3–1.5 times as broad as long, margin subtruncate. Lower face 0.72–0.78 times as broad as long, centrally obsoletely punctate, or punctostriate. Head in dorsal view with genae evenly constricted; posterior ocellus very close to eye; FI = 70–75%; occipital carina mediodorsally complete or obsolescent, ventrally incomplete, not curved towards hypostomal carina. Antenna slender, with 56–61 flagellar segments; 20th segment 1.9–2.1 times as long as broad.

Mesoscutum polished, with fine shallow punctures, in profile evenly rounded, with anterior margin slightly turned forwards; notauli vestigial. Mesopleuron polished, the upper and lower part punctostriate; epicnemial carina abruptly curved towards anterior margin of pleuron, but with upper end evanescent. Scutellum in profile weakly convex, laterally carinate for all of its length; scutellum in dorsal view 1.4–1.5 times as long as anteriorly broad, from finely shagreened to virtually smooth. Metapleuron quite strongly convex, generally finely diagonally striate; submetapleural carina evenly anteriorly broadened; posterior transverse carina of mesosternum complete. Propodeum in profile fairly abruptly declivous; anterior transverse carina complete, posterior transverse carina absent; anterior area moderately long, almost smooth, coriaceous or striate; spiracular area short, almost smooth; posterior area strongly rugose, the rugae tending to be concentric dorsally; lateral longitudinal carina present at least anteriorly, not distinctly joined to spiracular margin by a short carina.

Fore wing length 14–16 mm; discosubmarginal cell as in Fig. 230; AI = 0.84–1.00; CI = 0.54–0.67; ICI = 0.52–0.61; SDI = 1.14–1.28; *cu-a* from subopposite to base of *Rs&M* to proximal to it by about 0.2 of its own length; marginal cell proximally evenly hirsute; 1st subdiscal cell with anterior 0.4 sparsely hirsute. Hind wing with 7–8 hamuli on *R*1; 1st abscissa of *Rs* straight, 2nd abscissa straight.

Fore leg with tibia slightly flattened, with scattered spines on outer surface. Mid leg with longer tibial spur 1.5–1.6 times length of the shorter. Hind leg with coxa in profile 1.7–1.9 times as long as deep; trochantellus dorsally <0.1 times as long as broad; 4th segment of tarsus 2.4–2.6 times as long as broad; claws of female with long stout pectinae, those of male with pectinae slightly shorter.

Gaster slender; tergite 2 in profile 4.5–5.5 times as long as posteriorly deep, laterotergite upturned, thyridia oval to elliptical and separated from anterior margin of tergite by about 3–4 times its own length. Ovipositor slender, its sheath narrow. Male with sternites 7–9 bearing scattered erect hairs; gonosquama distally truncate to rounded, rarely pointed.

Colour generally pale yellowish brown, mesoscutum generally dark-marked and posterior segments of gaster infuscate; interocellar area yellowish; antenna golden; pterostigma golden; wings hyaline.

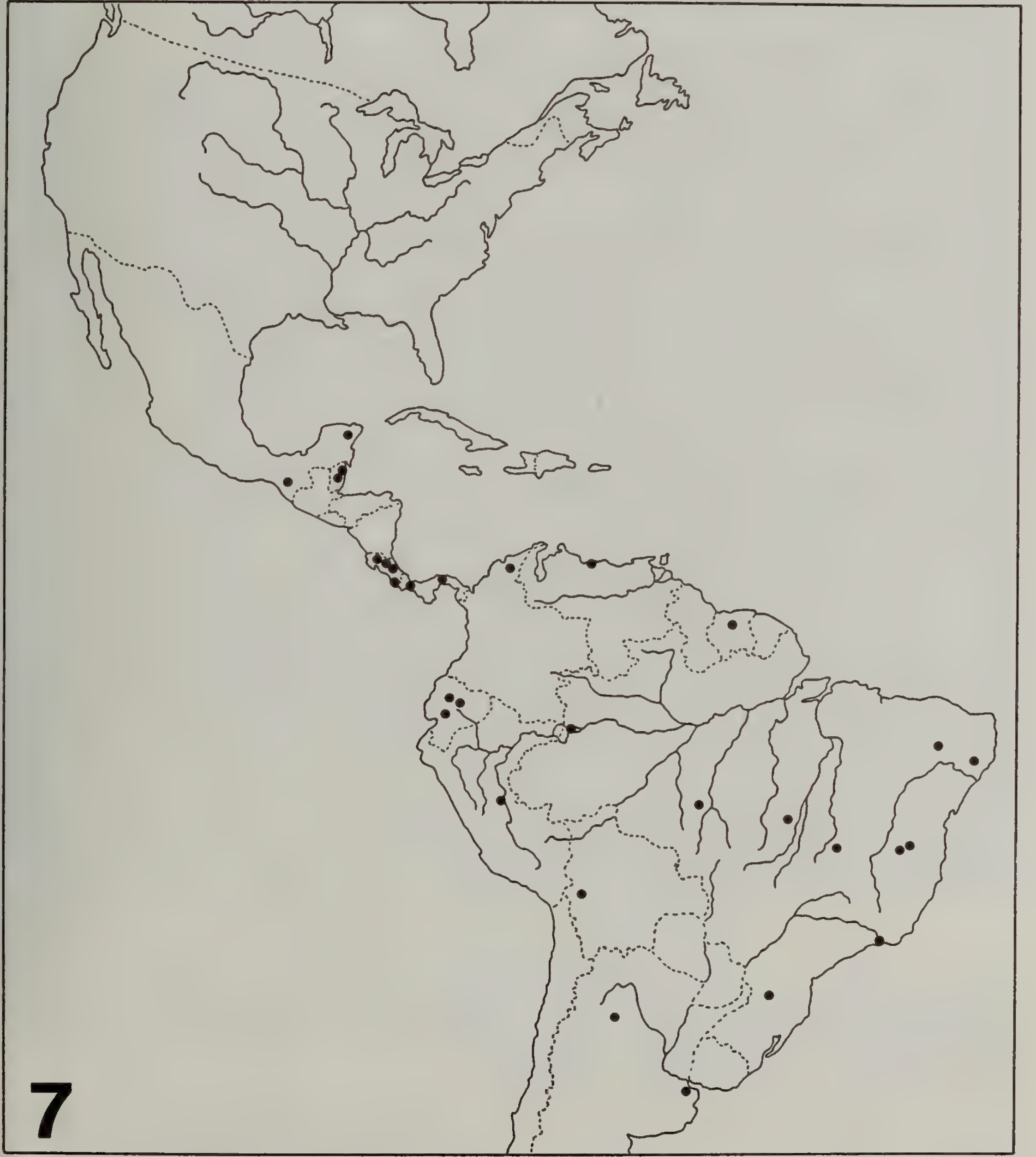
VARIATION. Most specimens have three dark brownish longitudinal marks on the mesoscutum, though in a few individuals these are absent, and occasional other specimens have the entire mesoscutum dark brown. Most specimens have tergites 3+ of the gaster infuscate, but a few individuals also have tergite 2 slightly infuscate also. Almost every individual has a small oval/triangular ill-defined sclerotized patch in the fenestra, but in a few specimens this area is very weakly represented.

REMARKS. This species is named after one of the great characters of Santa Rosa (*Agouti paca* III) who will be remembered by toothmarks on the boots of a generation of field biologists

Enicospilus scuintlei is structurally very similar to *E. robertoi*. Both species have similarly convex, striate metapleurae, similar mandibles, and have the 2nd subdiscal cell of the fore wing slightly broader than normal. The males of both species have a similar arrangement of rather sparse, long erect hairs on the posterior sternites. The colour pattern of the two species is also very similar. They differ principally in the form of the fenestra and the degree of sinuation of *Rs+2r*. This vein is less strongly sinuate in *E. robertoi*, but the sinuation extends virtually to the base of *Rs*; in *E. scuintlei* this vein is very strongly sinuate, but the most distal part is straight. The fenestra of *E. scuintlei* is broadly separated from the base of *Rs*, whilst in *E. robertoi* the distal fenestral margin reaches almost to *Rs*. *E. robertoi* has one and sometimes two distinct pigmented areas in the centre of the fenestra; the larger of these is oval/triangular and is quite large; the homologous sclerite in *E. scuintlei* is smaller and narrower.

Biological Information. *Enicospilus scuintlei* is a common and widely distributed species whose range extends from the southern states of Mexico southwards to northern Argentina (Map 7). In Central America it is most commonly encountered in relatively forested sites, below 1000 m. Despite relatively intensive collecting it has never been collected in lower montane forest at Monteverde, Costa Rica (1300 m). In Santa Rosa National Park, Costa Rica, it has been collected during the driest months of the year, and at the start of the wet season. Individuals have been collected later in the year. The pooled distributional data for 1981–4 at Santa Rosa are:

J	F	M	A	M	J	J	A	S	O	N	D
–	1	2	1	1	2	–	2	–	1	–	–



7

Map 7 Localities at which *Enicospilus scuintlei* has been collected.

On Barro Colorado Island, Panama, *E. scuintlei* has been collected in most months, but is absent at the start of the year. Pooled distributional data are:

J	F	M	A	M	J	J	A	S	O	N	D
–	–	–	3	7	4	4	1	1	–	1	2

A single specimen of this species has been reared by D. H. Janzen in Santa Rosa National Park from an unidentified species of Lasiocampidae (87-SRNP-1197) found feeding on *Ocotea*. This is an unusual host for species in this species-group as most others are only attack larvae of Saturniidae.

MATERIAL EXAMINED

Holotype ♀, **Costa Rica**: Alajuela Prov., Finca San Gabriel, 16 km E. of Quebrada Grande, vi.1986 (*Gauld*) (BMNH).

Paratypes. **Argentina**: 1 ♀, La Plata, xii.1965 (*Townes & Townes*) (TC); 1 ♂, Punta Lara, i.1966 (*Townes & Townes*) (TC). **Belize**: 1 ♀, Augustine, vii.1968 (*Hasse*) (BMNH); 1 ♂, 3 ♀, Middlesex, 125 m, v.1963 (*Welling*) (CNC); 1 ♀, Río Temas, vii.1937 (*White*) (BMNH). **Bolivia**: 1 ♀, Río San Pedro, Yungas de La Paz, 850 m, i.1976 (*Peña*) (TC). **Brazil**: 4 ♂, 43 ♀, Bahia, Encruzilhada, 960–980 m, xi.1972 & xi.1974 (*Alvarenga*) (TC); 1 ♀, Ceara, Barbalha, 400 m, v.1969 (*Alvarenga*) (TC); 1 ♀, Caruaru, 900 m, vi.1972 (*Lima*) (TC); 1 ♀, Goias, Jatai, xi.1972 (*Oliveira*) (TC); 1 ♀, Mato Grosso, 12°49'S 51°45'W, gallery forest, xi.1968 (*Knight*) (BMNH); 1 ♂, 1 ♀, Mato Grosso, Sinop, 12°31'S 55°37W, x.1974 & x.1975 (*Alvarenga*) (TC); 1 ♀, Minas Gerais, Pedra Azul, 800 m, xi.1972 (*Alvarenga & Seabra*) (TC); 1 ♂, Paraná, Quatro Barros, nr Curitiba, ii.1966 (*Townes & Townes*) (TC); 1 ♀, Rio de Janeiro, Itatiaia National Park, x.1969 (*Otero*) (TC); 7 ♂, 6 ♀, Santa Catarina, Nova Teutonia, 27°11'S 52°23'W, x.1935, i & xi.1938, i.1939, iii.1948, x.1951, xii.1953, iii.1956, i & x.1968 (*Plaumann*) (BMNH). **Colombia**: 1 ♀, Magdalena, 800 m, 1°10'N 74°8'W, iv.1973 (*Helava*) (BMNH). **Costa Rica**: Alajuela Prov.: 1 ♂, Finca Campana, 5 km NW. Dos Ríos, 750 m, iii.1985 (*Janzen & Hallwachs*) (BMNH); 1 ♂, Finca San Gabriel, 16 km E. Quebrada Grande, 630 m, iii.1983 (*Janzen & Hallwachs*) (BMNH); 1 ♀, same locality, vi.1986 (*Gauld*) (BMNH): Cartago Prov.: 1 ♀, Turrialba, iii.1965 (*Duckworth & Duckworth*) (USNM); 1 ♀, Tapanti, Río Grande de Orosi, 9°46'N 83°50'W, 1300–1400 m, i.1985 (*Janzen & Hallwachs*) (BMNH): Guanacaste Prov.: 5 ♂, 5 ♀, Santa Rosa National Park, 300 m, iii.1980, viii.1981, viii.1982, iii & x.1983, ii, iv-vi.1984 (*Janzen & Hallwachs*) (BMNH, TC); 4 ♀, Volcán Cacao, Estacion Mengo on SW. side, 1100 m, viii.1986, v-vi.1987 (*Janzen & Hallwachs*) (BMNH): Heredia Prov.: 1 ♀, Puerto Viejo de Sarapiqui, Finca La Selva, iii.1986 (BMNH): Limón Prov.: 1 ♂, Cerro Tortuguero, N. edge Tortuguero National Park, 0–100 m, v.1984 (*Janzen & Hallwachs*) (BMNH): Puntarenas Prov.: 1 ♀, Corcovado National Park, 20 m, v.1984 (*Gauld*) (BMNH); 1 ♂, Corcovado National Park, Sirena, i.1981, (*Janzen & Hallwachs*) (TC); 1 ♂, 1 ♀, San Vito de Las Cruces, xi.1987 (*Chacon*) (BMNH): San José Prov.: 2 ♂, 2 ♀, Estacion Carrillo, Braulio Carrillo National Park, 700 m, vii & x.1984, iv-v.1985 (*Chacon*) (BMNH). **Ecuador**: 1 ♂, 1 ♀, Cerro Tinajillas, Cumbaratza, 3100 m, iv.1965 (*Peña*) (BMNH); 1 ♀, Pichilingue, i.1974 (BMNH); 1 ♂, Pichincha, nr Nanegal, 1100 m, ix.1977 (*Peña*) (BMNH); 1 ♀, Río Palenque, Los Ríos, vi.1974 (*Longino*) (FSCA). **Mexico**: Chiapas: 1 ♀, Chiapas de Corzo, viii.1969 (*Kritsch*) (CNC): Quintana Roo: 1 ♀, X-can, viii.1963 (*Welling*) (CNC). **Panama**: 1 ♀, Barro Colorado Island, iv.1941 (*Zetek*) (USNM); 1 ♀, same locality, iv.1963 (*Rettenmeyer*) (TC); 1 ♀, same locality, vii.1963 (*Cavagnaro & Irwin*) (CAS); 12 ♀, same locality, iv-vii.1978 (*Wolda*) (RNH); 2 ♀, same locality, ix & xi.1982 (*Wolda*) (TC); 1 ♂, 6 ♀, same locality, viii, xii.1983, v, vii.1984, vi.1985 (*Wolda*) (BMNH); 2 ♂, 6 ♀, Cerro Campana, nr Chica, iv.1965 (*Duckworth & Duckworth*) (USNM); 1 ♀, Cerro Campana, xi.1959 (*Hanson*) (TC); 1 ♂, 1 ♀, same locality, viii.1970 (*Howden*) (TC); 1 ♀, Las Cumbres, i.1982 (*Wolda*) (TC). **Peru**: 1 ♂, Loreto, Pucallpa, i.1962 (*Schunke*) (BMNH). **Surinam**: 2 ♀, Krakka, xii.1962 (*Vreden*) (RNH); 1 ♀, Zanderij, ix.1964 (*Geijskes*) (TC). **Venezuela**: 1 ♀, El Junquito, 1040 m, iv.1938 (*Berthier*) (TC).

Enicospilus mexicanus (Cresson) **stat. n.**

(Figs 93, 95, 231)

Ophion mexicanus Cresson, 1874: 374. Holotype ♀, MEXICO (PANS) [examined].
Ophion (*Enicospilus*) *mexicanus* Cresson; Cameron, 1886: 290.
Enicospilus mexicanus (Cresson) Ashmead, 1895: 547.
Henicospilus mexicanus (Cresson) Morley, 1912: 36.

DESCRIPTION. Mandibles moderately long, basally strongly tapered, distally more evenly tapered, apically twisted 25–50°; upper mandibular tooth slightly compressed, 1.4–1.6 times as long as the lower tooth; outer mandibular surface centrally bearing fine, short, scattered hairs, with a weak proximal concavity. Labrum

0.2–0.3 times as long as broad; malar space 0.2–0.3 times as long as basal mandibular width. Clypeus in profile weakly convex, margin blunt; clypeus in front view 1.3–1.5 times as broad as long, with margin truncate. Lower face 0.68–0.74 times as broad as long, centrally obsoletely punctate, the areas between the punctures slightly roughened. Head in dorsal view with genae rounded behind the eyes; posterior ocellus contiguous with the eye; FI = 70–75%; occipital carina mediodorsally complete, ventrally quite strongly raised, curved towards and almost reaching hypostomal carina about 1.0–1.2 times the basal mandibular width away from mandible. Antenna slender, with 57–60 flagellar segments; 20th segment 1.7–1.8 times as long as broad.

Mesoscutum matt, microreticulate, in profile evenly rounded, margin slightly out-turned; notauli weak but discernible. Mesopleuron polished, the upper part with specular area obsoletely punctostriate, posteriorly grading to striate, the lower part more uniformly punctostriate/striate; epicnemial carina inclined towards anterior margin of pleuron, its upper end absent. Scutellum in profile weakly convex, laterally carinate for 0.8 or more of its length; scutellum in dorsal view 1.4–1.5 times as long as anteriorly broad, virtually smooth. Metapleuron moderately strongly convex, finely striate; submetapleural carina anteriorly quite broad, but almost parallel-sided; posterior transverse carina of mesosternum complete, or slightly weaker medially. Propodeum in profile abruptly declivous; anterior transverse carina complete, posterior transverse carina present laterally; anterior area short, steeply declivous, with scattered striae; spiracular area short, almost smooth; posterior area coarsely rugose, the rugae tending to be concentric mediodorsally; lateral longitudinal carina present anteriorly, not joined to spiracular margin by a distinct short carina.

Fore wing length 18–26 mm; discosubmarginal cell as in Fig. 231; AI = 0.87–1.11; CI = 0.53–0.62; ICI = 0.88–1.30; SDI = 1.19–1.54; *cu-a* proximal to base of *Rs&M* by 0.1–0.3 times its own length; marginal cell proximally evenly hirsute; 1st subdiscal cell with anterior 0.5 sparsely hirsute. Hind wing with 6–10 hamuli on *R*1; 1st abscissa of *Rs* straight, 2nd abscissa weakly bowed.

Fore leg with tibia quite strongly flattened, with strong scattered spines on outer surface. Mid leg with longer tibial spur 1.4–1.5 times length of the shorter. Hind leg with coxa in profile 1.5–1.7 times as long as deep; trochantellus dorsally <0.1 times as long as borad; 4th segment of tarsus 2.3–2.4 times as long as broad; claws of female large with close stout pectinae, those of male similar, but with pectinae a little shorter.

Gaster moderately slender; tergite 2 in profile 3.1–3.5 times as long as posteriorly deep, laterotergite pendant, thyridia oval and separated from anterior margin of tergite by about 3–4 times its own length. Female unusual in having subgenital plate large, in profile longer than sternite 5 (Fig. 93); ovipositor slender, its sheath narrow. Male with sternites 7–9 bearing long stout erect pubescence; gonosquama distally acute.

Colour generally yellowish brown, generally with head, mesoscutal stripes and scutellum paler yellow, gaster only very slightly infuscate; interocellar area yellow; antenna generally brownish, though in some specimens they are blackish; pterostigma golden; wings almost hyaline.

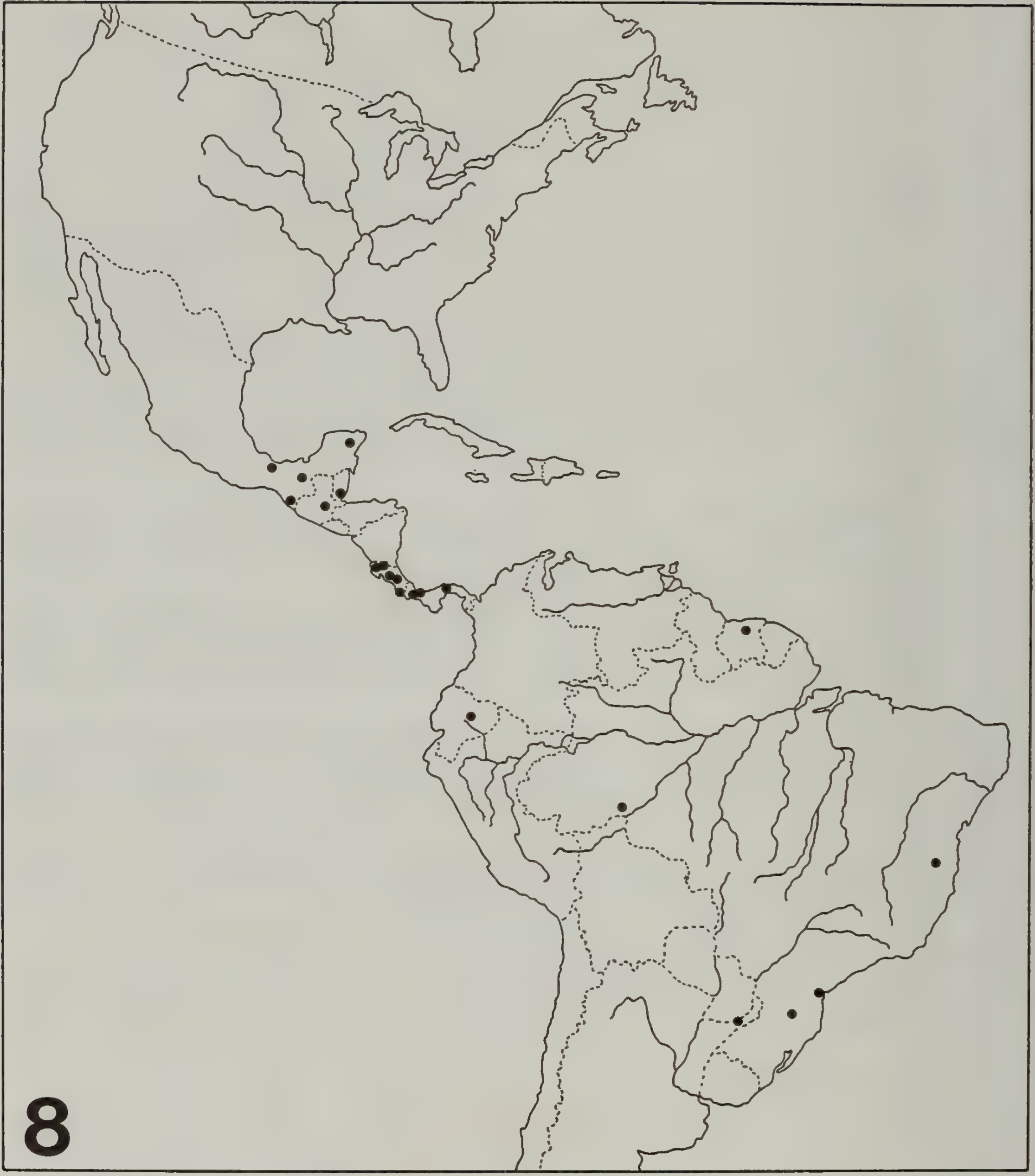
VARIATION. The most striking variation is in the torsion of the mandibles. Although the range given above extends from 25–50° only a very few specimens have the mandibles weakly twisted; most have them turned 40–50°. A few specimens have the mesoscutal vittae dark brown. The range of variation in the coloration of the antenna is quite unusual, but seems to occur within a population. Individuals with both black and brown antennae have been collected at the same site on Barro Colorado Island in May/June.

REMARKS. *Enicospilus mexicanus* is one of the most distinctive large species of the *E. americanus* complex. It can easily be recognized by the pendant laterotergite 2. Females are unusual in having a very large subgenital plate. Unlike many other species in this complex the genal carina (lower end of the occipital carina) often almost reaches the hypostomal carina. In this feature it resembles *E. cameronii* (see p. 147).

Hooker (1912) erroneously treated *E. mexicanus* as a junior synonym of *E. americanus* and ever since this synonymy has been accepted. However, the two species are quite clearly distinct, especially in the features mentioned in the preceding paragraph.

BIOLOGICAL INFORMATION. *Enicospilus mexicanus* is a widely distributed Neotropical species whose range extends from Mexico south of the tropic of Cancer to northern Argentina (Map 8). In Central America it is quite commonly collected in lowland rain forest, both on the eastern and western sides of the continent, and in humid lower montane forests up to an altitude of about 1400 m. In Braulio Carrillo National Park, Costa Rica, *E. mexicanus* has been collected in February, April to June, August and November. Although it is not common at Monteverde, a small number of specimens have been collected in various months, mostly in the first half of the year. The pooled seasonal data for Monteverde are:

J	F	M	A	M	J	J	A	S	O	N	D
4	1	3	–	3	–	1	–	–	–	–	1



Map 8 Localities at which *Enicospilus mexicanus* has been collected.

On Barro Colorado Island it is most common between May and September and only isolated individuals have been collected at other times of the year. The pooled data for Barro Colorado Island for 1978 and 1981–85 are:

J	F	M	A	M	J	J	A	S	O	N	D
1	–	1	1	9	10	7	2	4	2	3	1

E. mexicanus is uncommon in drier areas and only four individuals have been collected in Santa Rosa National Park. These were taken in mid June, early in the rainy season.

MATERIAL EXAMINED

Holotype ♀, **Mexico**: Veracruz: Cordoba (PANS).

Argentina: 1 ♀, Misiones, Panambi, xii.1957 (*Walz*) (TC). **Belize**: 1 ♀, Punta Gorda, x.1933 (*White*) (BMNH). **Brazil**: 2 ♀, Bahia, Encruzilhada, 960–980 m, xi.1972 & xi.1974 (*Alvarenga*) (TC); 1 ♂, Paraná, Quatro Barros, nr Curitiba, ii.1966 (*Townes & Townes*) (TC); 1 ♀, Rôndania, Vilhena, xi.1973 (*Alvarenga*) (TC); 2 ♂, 6 ♀, Santa Catarina, Nova Teutonia, xi.1940, vii.1951, iv.1952, i.1953, ii, iii & x.1954 (*Plaumann*) (TC). **Costa Rica**: Alajuela Prov: 2 ♂, 1 ♀, San Ramón Reserve, Río San Lorencito, xi.1986, ii.1987 (*Chacon*) (BMNH): Cartago Prov.: 1 ♀, Tapanti, iv.1984 (*Gauld*) (BMNH): Guanacaste Prov.: 1 ♀, Santa Rosa National Park, 300 m, vi.1979 (*Janzen*) (BMNH); 2 ♀, same locality, vi.1984 (*Janzen & Hallwachs*) (BMNH); 1 ♀, same locality, vi.1986 (*Gauld*) (BMNH); 1 ♀, Volcán Cacao, Finca La Luz [Estacion Mengo], 1100 m, i.1987 (*Janzen & Hallwachs*) (BMNH); 1 ♀, same locality, vi.1987 (*Janzen*) (BMNH): Puntarenas Prov.: 1 ♀, Finca Las Cruces, 6 km S. San Vito de Java, 1400 m, x.1986 (*Eger*) (BMNH); 1 ♀, Monteverde, xii.1961 (*Palmer*) (TC); 2 ♀, same locality, 1300–1400 m, v.1980 & vii.1982 (*Janzen & Hallwachs*) (BMNH); 1 ♀, same locality, v.1984 (*Fogden*) (BMNH); 1 ♂, 2 ♀, same locality, i, iii, v.1986 (*Haber*) (BMNH); 2 ♂, 4 ♀, same locality, i-iii.1986 (*Forsyth*) (CNC); 1 ♀, Sirena, Corcovado National Park, Osa Peninsula, i.1981 (*Janzen & Hallwachs*) (BMNH): San José Prov.: 1 ♂, 7 ♀, Estacion Carrillo, Braulio Carrillo National Park, 700 m, viii & xi.1984, ii, iv, v & vi.1985 (*Chacon*) (BMNH). **Ecuador**: 1 ♀, Pichincha, Tinlandia, 12 km E. Santo Domingo de los Colorados, 800 m, v.1986 (*Eger*) (BMNH). **Guatemala**: 1 ♀, Zacapa, San Lorenzo, 1700 m, xi.1986 (*Sharkey*) (CNC). **Mexico**: Chiapas: 1 ♀, Palenque, viii.1969 (*Kelton*) (CNC); 2 ♀, 35 km N. Huixtla, 1000 m, vi.1969 (*Peterson*) (CNC): Quintana Roo: 1 ♂, X-can, vi.1962 (*Welling*) (CNC). **Panama**: 1 ♀, Barro Colorado Island, Gatun Lake, iv.1941 (*Zetek*) (USNM); 4 ♂, 14 ♀, same locality, i, iii, v-vii, ix, x, xi.1978 (*Wolda*) (RNH); 1 ♂, 4 ♀, same locality, ix, xi-xii.1982 & v.1983 (*Wolda*) (TC); 2 ♂, 13 ♀, same locality, v, vi.1983, v, vi, vii, viii, ix, x.1984, iv, vi, vii, viii.1985 (*Wolda*) (BMNH); 1 ♀, Boquete, Alto Lino, 1300 m, viii.1977 (*Wolda*) (RNH); 1 ♂, Cerro Campana, nr Chica, iv.1965 (*Duckworth & Duckworth*) (USNM); 1 ♂, 1 ♀, Chiriqui, Fortuna, 1050 m, iii.1978 (*Wolda*) (RNH). **Surinam**: 1 ♀, Brownsweg, km 116, x.1961 (*Pypers*) (RNH).

Enicospilus abelardoi sp. n.

(Figs 94, 232)

DESCRIPTION. Mandibles long, proximally very strongly narrowed, especially ventrally where margin curves out slightly distally so narrowed point of mandible is near the centre, the extreme distal end parallel-sided; mandibles apically twisted 30–40°; upper mandibular tooth compressed, 1.4–1.6 times as long as the lower; outer mandibular surface flat or weakly concave, with hairs scattered along central part, with a moderately strongly developed proximal concavity. Labrum 0.3–0.4 times as long as broad; malar space 0.2–0.4 times as long as basal mandibular width. Clypeus in profile flat, margin acute; clypeus in front view 1.2–1.4 times as broad as long, with margin truncate. Lower face 0.67–0.74 times as broad as long, weakly polished, punctate shallowly, centrally grading to punctostriate. Head in dorsal view with genae rounded; posterior ocellus very close to eye; FI = 70–75%; occipital carina mediodorsally narrowly interrupted, ventrally curved towards hypostomal carina but lower end evanescent. Antenna long and slender, with 69–71 flagellar segments; 20th segment 1.5–1.7 times as long as broad.

Mesoscutum granulo-coriaceous, matt, in profile abruptly rounded; notauli weak. Mesopleuron matt, the upper part punctate with microreticulation on area between punctures, the lower part similar but coarser, tending to granulate; epicnemial carina inclined towards anterior margin of pleuron. Scutellum in profile pyramidal, its anterior part strongly raised, almost conical, and posteriorly abruptly declivous (Fig. 94); scutellum laterally carinate for 0.7+ of its length; scutellum in dorsal view 1.4–1.6 times as long as anteriorly broad, puncto-granulate, posteriorly wrinkled. Metapleuron moderately convex, upper part rugose, the lower part granulo-coriaceous; submetapleural carina strongly anteriorly broadened, usually with anterior corner quite sharp; posterior transverse carina of mesosternum complete. Propodeum in profile abruptly declivous, posterodorsally deplanate; anterior transverse carina more or less complete, strongly sinuous, posterior transverse carina discernible only as lateral crests; anterior area abruptly declivous, quite short, strongly striate; spiracular area short and granulate; posterior area very coarsely rugose-reticulate; lateral longitudinal carina present only anteriorly, not joined to spiracular margin by a short carina.

Fore wing length 23–28 mm; discosubmarginal cell as in Fig. 232; AI = 0.75–0.98; CI = 0.39–0.56; ICI = 0.45–0.87; SDI = 1.39–1.51; *cu-a* proximal to base of *Rs&M* by 0.1–0.2 times its own length; marginal cell proximally evenly hirsute; 1st subdiscal cell with anterior 0.6 and posterodistal corner hirsute. Hind wing with 9–13 hamuli on *R*1; 1st abscissa of *Rs* straight, 2nd abscissa weakly arcuate.

Fore leg with tibia quite strongly flattened, with long scattered spines on outer surface. Mid leg with longer tibial spur 1.3–1.4 times length of the shorter. Hind leg with coxa in profile 1.6–1.7 times as long as deep; trochantellus dorsally <0.1 times as long as broad; 4th segment of tarsus 2.2–2.4 times as long as broad; claws of female and male similar, strongly curved, with quite short, close pectinae.

Gaster long and slender; tergite 2 in profile more than 5.0 times as long as posteriorly deep, laterotergite normally folded under, thyridia small, obovate to cordate and separated from anterior margin of tergite by about 5–6 times its own length. Female with subgenital plate of moderate size, in profile only slightly longer than sternite 5 and posteromedially membranous; ovipositor exceptionally slender, its sheath narrow. Male with sternites 7–9 bearing scattered fine semidecumbent pubescence; gonosquama distally evenly rounded.

Colour generally quite uniformly brownish yellow with indistinct pale mesoscutal stripes; interocellar area yellowish; antenna dark brown, paler distally; pterostigma yellowish brown; wings weakly infumate.

VARIATION. None remarkable.

REMARKS. This species is named in honour of Abelardo Chacon, who has collected many of the ophionines examined in this work, and who has worked so hard on the moth fauna of Costa Rica.

Enicospilus abelardoi is a distinctive species on account of its very large size and its weakly sinuous *Rs+2r*; all the other very large species in the *E. americanus* complex have *Rs+2r* more strongly sinuous. *E. abelardoi* is particularly distinctive in the form of its scutellum which, in profile appears pyramidal, and is quite unlike that of any other Mesoamerican species. The form of the mandibles is also quite distinctive but is rather difficult to appreciate unless comparative material is at hand. Although the form of *Rs+2r* suggests *E. abelardoi* may be related to the complex of species that includes *E. aktites* (all of which have *Rs+2r* very weakly sinuate), the form of the propodeal sculpture and the shape of the claws suggest it may be more closely related to *E. cameronii*. The males of *E. cameronii*, however, have erect hairs on the posterior sternites.

BIOLOGICAL INFORMATION. *Enicospilus abelardoi* is only known from wet forests at altitudes between 700 and 800 m in Costa Rica. Its host is unknown, but its phylogenetic affinities and very large size suggest it parasitizes one of the largest saturniines; the exceptionally slender ovipositor suggests it may be ovipositing in relatively early instar larvae.

MATERIAL EXAMINED

Holotype ♀, **Costa Rica**: Alajuela Prov., San Ramón Reserve, Río San Lorencito, 800 m, v.1987 (*Chacon & Chacon*) (BMNH).

Paratypes. **Costa Rica**: 3 ♂, San José Prov., Estacion Carrillo, Braulio Carrillo National Park, 700 m, iii & v.1985 (*Chacon & Chacon*) (BMNH).

Enicospilus hallwachsae sp. n.

(Fig. 233)

DESCRIPTION. Mandibles moderately long, strongly narrowed so apex is slender, apically twisted 15–20°; upper mandibular tooth subcylindrical, 1.2–1.4 times as long as the lower tooth; outer mandibular surface with a broad shallow proximo-ventral concavity. Labrum 0.2–0.3 times as long as broad; malar space 0.2–0.3 times as long as basal mandibular width. Clypeus in profile very weakly convex, margin blunt; clypeus in front view 1.2–1.4 times as broad as long, margin truncate. Lower face 0.67–0.73 times as broad as long, centrally with very fine, sparse punctures. Head in dorsal view with genae rounded behind eyes; posterior ocellus contiguous with eye; FI = 65–70%; occipital carina mediodorsally complete, ventrally not reaching hypostomal carina. Antenna slender, with 60–62 flagellar segments; 20th segment 1.6–1.7 times as long as broad.

Mesoscutum weakly polished, sparsely punctate, in profile abruptly rounded; notauli vestigial. Mesopleuron polished, the upper part punctostriate, the lower part striate; epicnemial carina inclined towards anterior margin of pleuron. Scutellum in profile weakly convex, laterally carinate for all of its length; scutellum in dorsal view 1.3–1.5 times as long as anteriorly broad, anteriorly smooth, posteriorly rugulose. Metapleuron convex, granulate or finely diagonally striate, or exceptionally, rugose; submetapleural carina generally evenly anteriorly broadened; posterior transverse carina of mesosternum usually complete, or in Panamanian individuals weak to incomplete. Propodeum in profile abruptly declivous; anterior transverse carina complete, usually centrally raised, posterior transverse carina from absent to present laterally as a vestige; anterior area moderately long, striate; spiracular area short, abruptly declivous, punctate finely; posterior area rugose, the rugae tending to be concentric posterodorsally; lateral longitudinal carina present only anteriorly, not joined to spiracular margin by a short carina.

Fore wing length 15–18 mm; discosubmarginal cell as in Fig. 233; AI = 0.79–1.20; CI = 0.51–0.59; ICI = 0.76–1.06; SDI = 1.38–1.61; *cu-a* proximal to base of *Rs&M* by 0.1–0.4 times its own length; marginal cell proximally more or less evenly hirsute; 1st subdiscal cell with anterior 0.3 hirsute. Hind wing with 5–8 hamuli on *R*1; 1st abscissa of *Rs* almost straight, 2nd abscissa straight.

Fore leg with tibia slightly flattened, with a few strong spines on outer surface. Mid leg with longer tibial spur 1.3–1.4 times length of the shorter. Hind leg with coxa in profile 1.6–1.7 times as long as deep; trochantellus dorsally <0.1 times as long as broad; claws of female large, with short close pectinae, those of male similar.

Gaster slender; tergite 2 in profile 3.7–4.3 times as long as posteriorly deep, laterotergite turned under, thyridia small, obovate and separated from anterior margin of tergite by about 4–5 times its own length. Ovipositor slender, its sheath narrow. Male with sternites 7–9 bearing long stout erect hairs; gonosquama long, apically somewhat acute, usually with upper distal corner slightly produced.

Colour generally yellowish brown, head brighter yellow, mesoscutum with weak to quite strong darker brownish vittae, gaster slightly infuscate; interocellar area yellowish; antenna brownish orange, generally infuscate or even blackish proximally; pterostigma golden; wings hyaline.

VARIATION. Occasional specimens have the antennae almost entirely black. The female from Belize has the metapleuron punctate and so have the five specimens from Chiriqui, Panama. These five specimens may possibly represent a separate species for, in addition to having the metapleuron punctate, they have the posterior transverse carina of the mesosternum centrally weak or incomplete, their general colour is darker brown, and the males have slightly coarser erect hairs on the posterior sternites.

I have seen a single damaged male labelled 'Trinidad' (in RNH), which runs to this species in the key. It differs in having a more finely sculptured alitrunk, with the metapleuron striate, and an exceptionally large male genital capsule. It appears to be a distinct species but I have refrained from formally describing it until more material is available (and which 'Trinidad' it was collected in becomes apparent).

REMARKS. This species is named in honour of Winifred Hallwachs who has baked many butterscotch brownies, collected ichneumonids at hours when most sane people are asleep, and inspired the moth study that led to this ichneumonid study.

Enicospilus hallwachsae belongs to a species-complex that is characterized by having an almost straight *Rs+2r*. Within this group it appears to be very closely related to *E. aktites* which it resembles in having slender mandibles and similar venation. *E. hallwachsae* differs in having *Rs+2r* very slightly more slender, in lacking the distinct small central sclerite and in being rather darker in colour.

BIOLOGICAL INFORMATION. *Enicospilus hallwachsae* is a rarely collected species that is widely distributed from Belize south to Brazil. It occurs in rather wetter habitats than does *E. aktites* and in Costa Rica it is associated with rainforests between 600 and 1100 m, mostly on the Atlantic side of the continent. In northern Costa Rica it has been collected near the continental divide at 630 m. Despite extensive collecting it has not been collected in lowland forest on Barro Colorado Island, or in lower montane forest at Monteverde (1300 m).

MATERIAL EXAMINED

Holotype ♂, **Costa Rica**: Alajuela Prov., Finca San Gabriel, 16 km E. Quebrada Grande, 630 m, iii.1983 (*Janzen & Hallwachs*) (BMNH).

Paratypes. **Belize**: 1 ♂, Camp Sibim, Coyo Dist., v.1963 (CNC). **Brazil**: 1 ♂, Santa Catarina, Nova Teutonia, v.1953 (*Plaumann*) (TC). **Costa Rica**: Alajuela Prov.: 1 ♂, Finca San Gabriel, 16 km E. Quebrada Grande, 630 m, iii.1983 (*Janzen & Hallwachs*) (BMNH); 1 ♂, same locality, vi.1986 (*Gauld*) (BMNH); 1 ♀, Caché, 1914 (*Rogers*) (BMNH): San José Prov.: 1 ♂, 3 ♀, Estacion Carrillo, Braulio Carrillo National Park, 700 m, vii-viii.1984, iii.1985 (*Chacon*) (BMNH). **Panama**: 3 ♂, 2 ♀, Chiriqui, Fortuna, 1050 m, i-iv.1978 (*Wolda*) (RNH).

Non-paratypic material. **Trinidad:** 1 ♂ (*de Voogd*) (RNH).

Enicospilus cameronii (Dalla Torre)

(Figs 159, 234)

Ophion curvinervis Cameron, 1886: 293. Lectotype ♀, GUATEMALA, (BNMH) designated by Townes & Townes (1966: 175) [examined]. Homonym of *Ophion curvinervis* Kriechbaumer, 1878.

Ophion cameronii Dalla Torre, 1901: 188. Replacement name for *curvinervis* Cameron.

Ophiomorpha curvinervis (Cameron) Szépligeti, 1905: 35.

Ophion latilineatus Cameron, 1911: 179. Holotype ♀, GUYANA (BMNH) [examined]. Synonymized by Morley, 1914: 409.

Allocamptus renovatus Morley, 1912: 23. Replacement name for *curvinervis* Cameron.
Cymatoneura renovata (Morley) Brèthes, 1927: 323.
Enicospilus cameronii (Dalla Torre) Cushman, 1947: 466.

Description. Mandibles moderately long, proximally strongly narrowed, distally almost parallel-sided, apically twisted 20–30°; upper mandibular tooth slightly compressed, 1.2–1.4 times as long as the lower tooth, and slightly divergent from it; outer mandibular surface centrally finely pubescent, proximally almost flat. Labrum 0.2–0.3 times as long as broad; malar space 0.3–0.4 times as long as basal mandibular width. Clypeus in profile almost flat, margin blunt to subacute; clypeus in front view 1.4–1.6 times as broad as long, with margin truncate. Lower face 0.70–0.83 times as broad as long, centrally obsoletely punctate. Head in dorsal view with genae rounded behind eye; posterior ocellus contiguous with eye; FI = 70–75%; occipital carina mediodorsally generally slightly depressed, sometimes narrowly interrupted, ventrally curved towards the hypostomal carina but usually not joining it, though in a few individuals these carinae do join. Antenna moderately slender, with 61–70 flagellar segments; 20th segment 1.7–1.9 times as long as broad.

Mesoscutum weakly polished, finely punctate, in profile abruptly rounded; notauli vestigial. Mesopleuron weakly polished, the upper part punctostriate, grading in the lower part to striate; epicnemial carina inclined towards anterior margin of pleuron. Scutellum in profile moderately convex, laterally usually carinate for 0.9 or more of its length, rarely with carinae only extending 0.5 of its length; scutellum in dorsal view 1.4–1.5 times as long as anteriorly broad, anteriorly smooth, posteriorly often striate. Metapleuron posterodorsally convex, ventrally flattened, more or less matt, finely rugulose, or granulate; submetapleural carina evenly anteriorly broadened; posterior transverse carina of mesosternum complete, centrally produced into a squared-off lobe. Propodeum in profile abruptly declivous; anterior transverse carina sinuous, usually complete, rarely with lateromedian discontinuities, posterior transverse carina represented laterally by crests; anterior area deeply impressed, striate; spiracular area very short and almost smooth; posterior area coarsely rugose (Fig. 159), the rugae posteriorly tending to be concentric; lateral longitudinal carina present anteriorly, not joined to spiracular margin by a short carina.

Fore wing length 17–27 mm; discosubmarginal cell as in Fig. 234; AI = 0.78–1.40; CI = 0.59–0.61; ICI = 0.51–0.80; SDI = 1.25–1.46; *cu-a* proximal to *Rs&M* by 0.2–0.4 times its own length; marginal cell proximally usually evenly hirsute, sometimes with a small glabrous area; 1st subdiscal cell with anterior and distal margins hirsute. Hind wing with 9–14 hamuli on *R*1; 1st abscissa of *Rs* straight, 2nd abscissa weakly bowed.

Fore leg with tibia strongly flattened, with scattered stout spines on outer surface. Mid leg with longer tibial spur 1.3–1.5 times length of the shorter. Hind leg with coxa in profile 1.6–1.7 times as long as deep; trochantellus dorsally <0.1 times as long as broad; 4th segment of tarsus 2.5–2.7 times as long as broad; claws of female large, with strong, close pectinae, those of male similar but with pectinae slightly closer and shorter.

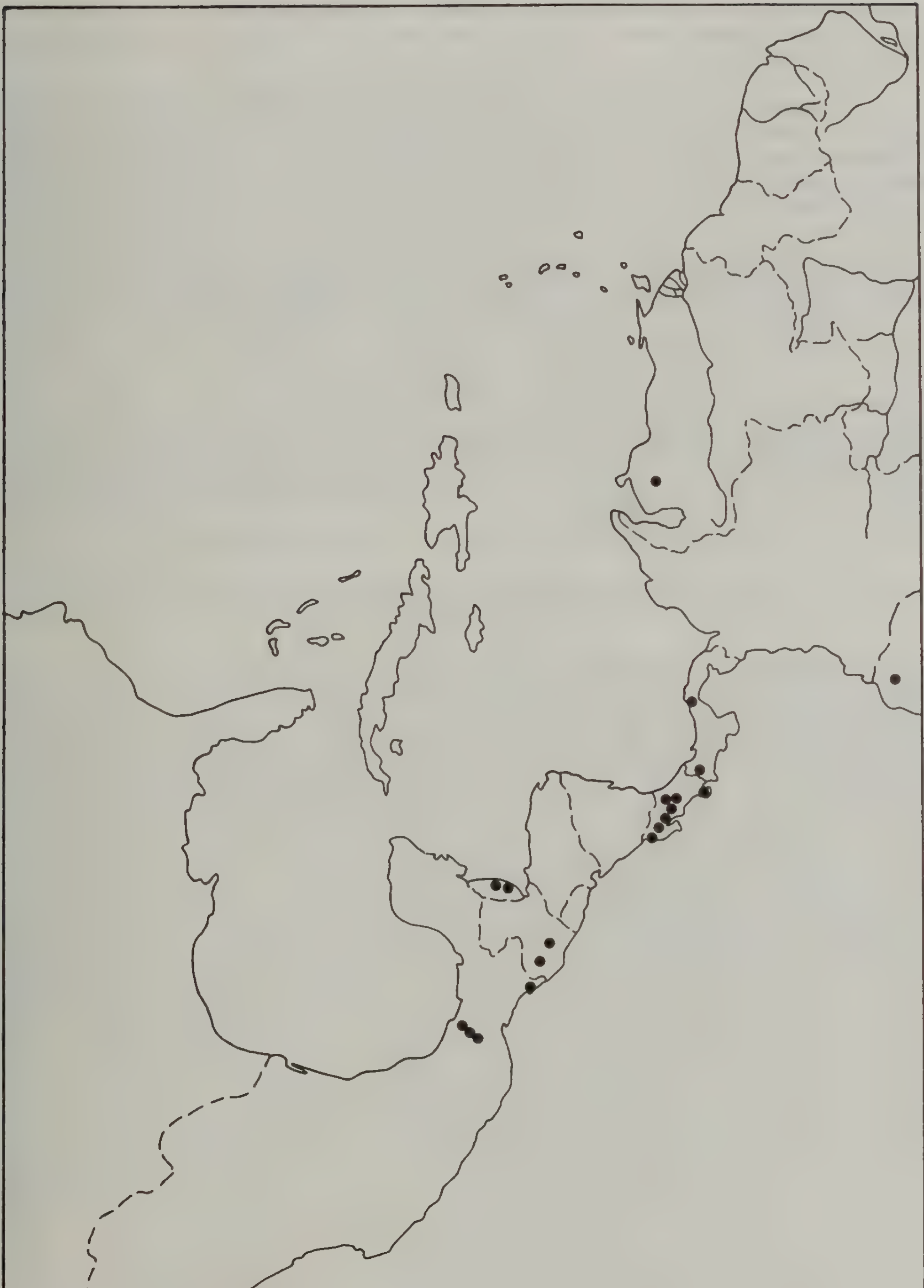
Gaster quite slender; tergite 2 in profile 4.4–5.6 times as long as posteriorly deep, laterotergite folded under, or in a few individuals with extreme posterior part slightly pendant; thyridia obovate and separated from anterior margin of tergite by about 3.5–4.5 times its own length. Female with subgenital plate large, conspicuously longer than sternite 5; ovipositor slender, its sheath a little stouter than is normal for species in this complex. Male with sternites 7–9 bearing dense long erect pubescence; gonosquama distally elongately rounded or acute.

Colour generally yellowish brown with head paler yellowish; upper part of mesopleuron, mesoscutal stripes and scutellum often yellow; interocellar area yellow; antenna blackish; pterostigma golden; wings very weakly infumate.

Variation. *Enicospilus cameronii* is a morphologically rather uniform species that shows most variation in the sculpture of the metapleuron. Generally the metapleuron is more or less granulate to rugulose but occasional individuals have it somewhat striate, or even rugose. Specimens from Fortuna, Chiriqui, Panama have the alitrunks slightly darker than other material.

Remarks. *Enicospilus cameronii* appears to be closely related to *E. mexicanus*. Both species have a comparatively large female subgenital plate and have the lower part of the occipital carina reaching or almost reaching to the hypostomal carina. *E. cameronii* differs from *E. mexicanus* in having the epipleuron 2 more or less completely turned under, and in having a smaller ICI (<0.80). *E. cameronii* is most easily distinguished from other species in the *E. americanus* complex by the possession of a black flagellum and in having the propodeum very coarsely sculptured.

Biological Information. The range of *Enicospilus cameronii* extends from Oaxaca, Mexico south to equatorial South America (Map 9). It seems to be associated with wet forests from sea-level up to altitudes of about 1400 m. Most specimens have been collected in the first six months of the year.



Map 9 Localities at which *Enicospilus cameronii* has been collected.

MATERIAL EXAMINED

Lectotype ♀ (*Ophion curvinervis* Cameron), **Guatemala**: Las Mercedes, 1000 m (*Champion*) (BMNH); paralectotype 1 ♂, **Guatemala**: Senahu, Vera Paz (*Champion*) (BMNH). Holotype ♀ (*Ophion latilineatus* Cameron), Guyana (BMNH).

Belize: 1 ♂, 1 ♀, Columbia Forest, vii.1968 (*Hasse*) (BMNH); 1 ♀, Río Temas, iv.1937, (*White*) (BMNH). **Costa Rica**: Alajuela Prov.: 1 ♂, 1 ♀, Finca Campana, 5 km NW. Dos Ríos, 750 m, iii.1985 & i.1986 (*Janzen & Hallwachs*) (BMNH); 1 ♂, 3 km W. Dos Ríos, Finca San Gabriel, 800 m, vi.1986 (*Gauld*) (BMNH): Guanacaste Prov.: 1 ♂, 4 km E. Casetilla, Rincón National Park, 750 m, i.1982, (*Janzen & Hallwachs*) (BMNH); 1 ♀, Volcán Orosi, Casa Mariksa [Maritza], v.1986 (*Gauld*) (BMNH): Puntarenas Prov.: 1 ♂, 2 ♀, Monteverde, 1300 m, ii, vii.1961, ii.1962 (*Palmer*) (TC); 1 ♀, same locality, iv-v.1984 (*Gauld*) (BMNH); 3 ♀, 3 ♀, same locality, i-ii, v.1986 (*Haber*) (BMNH); 1 ♀, Sirena, Corcovado National Park, Osa Peninsula, iii.1981 (*Janzen & Hallwachs*) (BMNH): San José Prov.: 1 ♂, 2 ♀, Estacion Carrillo, Braulio Carrillo National Park, 700 m, ix.1984, iii & v.1985 (*Chacon*) (BMNH); 2 ♀, La Montura, Braulio Carrillo National Park, 1100 m, xii.1981 (*Janzen & Hallwachs*) (BMNH); 2 ♀, San Antonio de Escazú, 1300 m, v-vi.1981 (*Eberhard*) (UM). **Ecuador**: 1 ♂, Otavalo to Apuela, 2200 m, ix.1977 (*Peña*) (TC). **Guatemala**: 1 ♀, Tabril, 1931 (MCZ). **Mexico**: Chiapas: 1 ♂, 32 km N. Huixtla, 1000 m, vi.1969 (*Mason*) (CNC); 1 ♂, 1 ♀, 32 km N. Huixtla, 1000 m, vi.1969 (*Peterson*) (CNC); 2 ♀, 32 km N. Huixtla, 1000 m, vi.1969 (CNC): Oaxaca: 1 ♀, 140 km on Highway 175, 1200 m, v.1969 (*Howden*) (CNC); 1 ♀, Temascal, viii.1966 (*Lau*) (USNM); 1 ♀, 20 km S. Valle Nacional, 1000 m, v.1971 (*Howden*) (TC). **Panama**: 1 ♂, Barro Colorado Island, vii.1961 (*Campbell*) (CNC); 5 ♂, 17 ♀, Chiriqui, Fortuna, 1050 m, i, iv-vi, x-xi.1978 (*Wolda*) (RNH); 1 ♀, Las Cumbres, 150 m, vi.1984 (*Wolda*) (BMNH). **Venezuela**: 1 ♀, El Blanquito, Lara, x.1978 (*Osorio*) (FSCA).

Enicospilus gamezi sp. n.

(Figs 160, 235)

DESCRIPTION. Mandibles quite stout, long, distally almost parallel-sided, apically twisted 10–20°; upper mandibular tooth subcylindrical, 1.8–2.0 times as long as the lower tooth; outer mandibular surface almost flat centrally, with a weak proximal concavity. Labrum 0.2–0.3 times as long as broad; malar space 0.2–0.3 times as long as basal mandibular width. Clypeus in profile flat to slightly out-flared, margin slightly blunt; clypeus in front view 1.4–1.5 times as broad as long, its margin truncate to weakly convex. Lower face 0.77–0.85 times as broad as long, centrally regularly but finely punctate. Head in dorsal view with genae evenly rounded behind eye; posterior ocellus close to eye; FI = 60–65%; occipital carina mediodorsally narrowly incomplete, ventrally evanescent, remote from the hypostomal carina. Antenna slender, with 57–69 flagellar segments; 20th segment 2.2–2.3 times as long as broad.

Mesoscutum polished, finely granulate with obsolescent punctures, in profile steeply but evenly rounded; notauli vestigial. Mesopleuron polished, the upper part punctate with a few striae posteriorly, the lower part punctostriate; epicnemial carina curved towards anterior margin of pleuron, but with upper end evanescent. Scutellum in profile moderately convex, laterally carinate for 0.9 of its length; scutellum in dorsal view 1.5–1.6 times as long as anteriorly broad, rather smooth, with striae posteriorly. Metapleuron weakly convex, diagonally striate; submetapleural carina narrow, weakly anteriorly broadened; posterior transverse carina of mesosternum complete. Propodeum in profile evenly rounded; anterior transverse carina present but rather weak, posterior transverse carina absent; anterior area moderately long, striate or rugulose; spiracular area short, almost smooth; posterior area transversely rugulose (Fig. 160); lateral longitudinal carina present only anteriorly, not joined to spiracular margin by a short carina.

Fore wing length 13–19 mm; discosubmarginal cell as in Fig. 235; AI = 0.80–1.23; CI = 0.37–0.52; ICI = 0.54–0.84; SDI = 1.21–1.27; *cu-a* from slightly distal to the base of *Rs&M* to proximal to *Rs&M* by 0.1–0.2 times its own length; marginal cell proximally very slightly more sparsely hirsute; 1st subdiscal cell with anterior 0.5–0.7 hirsute. Hind wing with 5–8 hamuli on *R*1; 1st abscissa of *Rs* straight, 2nd abscissa weakly bowed.

Fore leg with tibia weakly flattened, with scattered spines on outer surface. Mid leg with longer tibial spur 1.3–1.4 times length of the shorter. Hind leg with coxa in profile 1.6–1.8 times as long as deep; trochantellus dorsally <0.1 times as long as broad; 4th segment of tarsus 2.6–3.1 times as long as broad; claws of female long, distally abruptly curved, with fine close pectinae, those of male similar.

Gaster slender; tergite 2 in profile 4.1–4.3 times as long as posteriorly deep, laterotergite folded under, thyridia oval and separated from anterior margin of tergite by about 3–4 times its own length. Ovipositor slender, its sheath narrow. Male with sternites 7–9 bearing fine decumbent pubescence; gonosquama distally slightly acute.

Colour generally yellowish brown with head paler yellowish and gaster very weakly infuscate posteriorly; interocellar area yellowish; antenna blackish; pterostigma golden brown; wings hyaline.

VARIATION. None remarkable.

REMARKS. This species is named in honour of Professor Rodrigo Gamez who has done so much in welding the political and academic community to the conservation cause in Costa Rica.

Enicospilus gamezi is rather similar to, though generally smaller than, *E. cameronii*. *E. gamezi* differs in that the female does not have quite such an elongate subgenital plate, the male has the terminal sternites finely pubescent, both sexes have more slender central flagellar segments and stouter, longer mandibles. The propodeal sculpture of *E. gamezi* is far less strong than that of *E. cameronii*, and it lacks the lateral vestiges of the posterior transverse carina.

BIOLOGICAL INFORMATION. *Enicospilus gamezi* is only known from north-western Costa Rica. It is apparently restricted to rather open deciduous forest. The adults are active throughout the wet season from the end of May until November. Pooled data for 1977–85 are:

J	F	M	A	M	J	J	A	S	O	N	D
–	–	–	–	–	5	1	4	1	2	1	–

About one-quarter of the specimens examined have very worn mandibles, suggesting that this species may emerge from a hard pupal cell in the ground.

MATERIAL EXAMINED

Holotype ♂, **Costa Rica**: Guanacaste Prov., Santa Rosa National Park, 300 m, viii.1983 (*Janzen & Hallwachs*) (BMNH).

Paratypes. **Costa Rica**: Guanacaste Prov.: 7 ♂, 6 ♀, Santa Rosa National Park, 300 m, viii, x, xi.1977 vi, vii, viii.1978, vi, ix.1983, vi.1984, vi.1985 (*Janzen & Hallwachs*) (BMNH, MNCR).

***Enicospilus texanus* (Ashmead)**

(Figs 99, 236)

Thyreodon texanus Ashmead, 1890: 422. Holotype ♂, U.S.A.: Texas (USNM) [examined].
Eremotylus texanus (Ashmead) Ashmead, 1896: 23.
Macrophion texanus (Ashmead) Morley, 1912: 14.
Enicospilus texanus (Ashmead) Townes, 1945: 745.

DESCRIPTION. Mandibles long, weakly tapered proximally, distally almost parallel-sided, apically twisted 10–15°; upper mandibular tooth subcylindrical, 1.2–1.7 times as long as the lower tooth; outer mandibular surface centrally with fine sparse pubescence proximally, generally weakly concave, with a weak proximal concavity. Labrum 0.2–0.3 times as long as broad; malar space sexually dimorphic, of ♀ 0.3–0.5, and of ♂ 0.5–0.8 times as long as basal mandibular width. Clypeus in profile flat, sometimes slightly out-flared, margin rather blunt; clypeus in front view 1.5–1.8 times as broad as long, its margin truncate. Lower face of ♀ 0.86–1.05, of ♂ 0.94–1.25 times as broad as long; face centrally smooth and polished, with scattered coarse punctures. Head in dorsal view with genae slightly inflated in ♀, buccate in ♂; posterior ocellus from close to eye to separated from it by about 0.2 its own maximum diameter in ♀, in ♂ separated from eye by 0.2–0.3 times the maximum ocellar diameter; FI of ♂ 45–50%, of ♀ 50–55%; occipital carina mediodorsally narrowly interrupted, ventrally curved to nearly join hypostomal carina about 0.8–0.9 times the basal mandibular width away from mandible, but with lower end evanescent so the two carinae do not actually meet. Antenna moderately slender, with 53–61 flagellar segments; 20th segment 1.5–1.8 times as long as broad.

Mesoscutum polished, with close punctures, in profile steeply rounded; notauli vestigial. Mesopleuron polished, rather coarsely punctate, though posterodorsally and medioventrally tending to punctostriate; epicnemial carina curved towards anterior margin of pleuron but with upper end evanescent. Scutellum in profile weakly to moderately convex, laterally carinate for most of its length though often with carina degenerating into a series of wrinkles posteriorly, sometimes with the carinae weak; scutellum in dorsal view 1.2–1.3 times as long as anteriorly broad, with deep punctures, posteriorly somewhat striate. Metapleuron convex, punctate, rarely punctostriate; submetapleural carina evenly anteriorly broadened; posterior transverse carina of mesosternum more or less complete, sometimes a little protuberant centrally. Propodeum in profile abruptly declivous, posterodorsally deplanate; anterior transverse carina present, often weak and discontinuous, posterior transverse carina represented by a lateral vestige;

anterior area short, deeply impressed, rugose/striate; spiracular area short and punctate, posterior area rugose/reticulate, the rugae tending to concentric posterodorsally; lateral longitudinal carina only present anteriorly, not joined to spiracular margin by a short carina.

Fore wing length 15–18 mm; discosubmarginal cell as in Fig. 236; AI = 0.64–1.46; CI = 0.46–0.73; ICI = 0.61–0.86; SDI = 1.35–1.50; *cu-a* proximal to base of *Rs&M* by 0.1–0.3 times its own length; marginal cell proximally generally slightly more sparsely hirsute distally; 1st subdiscal cell generally extensively hirsute, often only with centre or posterior margin glabrous. Hind wing with 8–12 hamuli on *R*1; 1st abscissa of *Rs* almost straight, 2nd abscissa weakly curved.

Fore leg with tibia weakly flattened, with numerous slender spines on outer surface. Mid leg with longer tibial spur 1.2–1.4 times length of the shorter. Hind leg with coxa in profile 1.5–1.7 times as long as deep; trochantellus dorsally <0.1 times as long as broad; 4th segment of tarsus 2.1–2.6 times as long as broad; claws of female long and weakly curved, with stout pectinae (Fig. 99), those of male similar, with pectinae slightly closer.

Gaster moderately stout; tergite 2 in profile 2.5–3.8 times as long as posteriorly deep, laterotergite turned under, thyridia elongately obovate and separated from anterior margin of tergite by about 1.5–2.0 times its own length. Ovipositor slender, its sheath narrow. Male with sternites 7–9 bearing rather fine, long,, erect hairs amid decumbent pubescence; gonosquama distally rounded.

Colour generally dark reddish or orange-brown, usually with head and scutellum slightly paler; interocellar area orange; antenna orange-brown slightly infuscate apically; pterostigma orange; wings quite strongly infumate.

VARIATION. I have seen three specimens (in BMNH and USNM) from Arizona, U.S.A., all reared, which differ from typical examples of the species in being slightly smaller (fore wing length about 14 mm) and having almost hyaline wings.

REMARKS. *Enicospilus texanus* is easily recognized by the dark wings and the sexually dimorphic head. The broad face, long malar space and buccate genae of the male are quite distinctive. Structurally this species is similar to *E. halffteri* in sculpture, venation and form of the mandibles. However, *E. texanus* has a broader face, wider malar space, more spinose hind tarsi and, usually, darker wings than does *E. halffteri*.

BIOLOGICAL INFORMATION. This species is widespread throughout the southern states of the U.S.A. from Virginia westwards to the Pacific coast, and it is reputed to extend as far north as Washington (Carlson, 1979). In the east there are occasional records of it from as far north as Ohio. In the south its range extends into northern Mexico, though it does not seem to occur in tropical Central America. *Enicospilus texanus* is a larval endoparasitoid of (mostly) hemileucine saturniids. In the United States it commonly has been reared as a larval parasitoid of *Hemileuca maia* (Drury), a saturniid that is common in drier scrubby areas of the eastern United States (Ferguson, 1971). *E. texanus* has also been reared from *H. peigleri* Lemaire (Lemaire, 1981). R. Peigler informs me that this species also parasitizes *H. magnifica* (Rotger). In the USNM are two specimens that are similar to *texanus*, but may not be conspecific with it (see variation above), which have been reared from *Hemileuca tricolor* (Packard), and in the BMNH is a very similar specimen that has been reared from *Hemileuca juno* Packard. In northern Mexico, *E. texanus* has been reared from the larva of *Hemileuca oliviae* Cockerell, an occasional pest of range lands (Fritz *et al.*, 1986). R. Peigler has also reared *E. texanus* from the saturniine, *Agapema galbina* (Clemens).

In the USNM is a single specimen of *texanus* that is labelled as having been reared from the ennomine geometrid *Eucaterva variaria* (Grote). This record is erroneous as the purported host is too small to support such a large parasitoid.

Fritz *et al.* (1986) observed that the larva of *E. texanus* killed its larval host after the saturniid had spun a cocoon. The ichneumonid constructed a tough ovoid fibrous cocoon in the host cocoon, underneath the remains of the saturniid larva. This larval skin, which bears urticating spines, may serve to protect the ichneumonid cocoon. The single specimen I have seen from a saturniine (*Agapema galbina*) also constructed its cocoon within the rather loose host cocoon. The cocoon of *E. texanus* is particularly thick and, like other ophionines, internally impregnated with a cellophane-like substance that presumably serves to reduce water-loss and protects the larva from micro-organisms. The cocoon of *texanus* is remarkable in having a well-developed, free, inner cellophane-like envelope that completely ensheaths the prepupa and pupa. This has its own cap, separate from the usual external cap. Possibly this additional layer, another barrier to water-loss, allows *texanus* to diapause as larvae for long periods in relatively dry localities.

In some cases individuals of *E. texanus* enter prolonged diapause. For example, the individual reared from *Agapema* spun a cocoon in May 1981, but did not emerge until January 1983.

MATERIAL EXAMINED

Holotype ♂, **U.S.A.**: Texas (USNM).

Mexico: Chihuahua: 1 ♂, 1 ♀, 3 km W. Anehuac, ex *H. oliviae*, x.1983 (*Fritz*) (BMNH). **U.S.A.**: Arizona: 1 ♀, Pima County, E. of Tucson, iv.1987 (*Hyatt*) (BMNH); 1 ♂, 1 ♀, Tombstone, x.1934 (*Wehrle*) (USNM); 2 ♀, Tucson, iii.1936, iv.1937 (*Bryant*) (CAS): California: 1 ♂, Lake Tahoe, ix.1915 (*Dyar*) (USNM); 5 ♀, Sequioa Natl. Park (CAS): Florida: 4 ♀, Highlands Co., Archbold Biological Station, iii.1962 (*Ferguson*) (USNM); 1 ♀, Lake Placid, v.1968 (*Heinrich*) (CNC); 3 ♀, Lake Placid iv.1979 (CNC): Georgia: 1 ♂, Waycross, iii.1952 (*Gillis*) (CNC): New Mexico: 1 ♀, Taos, vii.1934 (*Craig*) (CAS): North Carolina: 1 ♀, Highlands, iv.1957 (*Mason*) (CNC): Texas: 1 ♂, Brewster Co., i.1969 (*Kendall*) (USNM); 1 ♀, Reeves Co., US Highway 285, 3 km SE. of Orla, ex *A. galbina* larva feeding on *Condalia ericoides* (*Kendall & Kendall*) (BMNH); 1 ♀, San Antonio, iii.1930 (*Seaton*) (USNM); 1 ♀, San Antonio, iii.1957 (*Kendall*) (USNM): Virginia; 1 ♀, Mountain L. vii.1940 (*Milne*) (USNM).

Enicospilus cushmani Gauld

(Fig. 237)

Enicospilus cushmani Gauld, 1988: 41. Holotype, ♀ U.S.A.: Florida (USNM) [examined].

DESCRIPTION. Mandibles moderately short, fairly evenly tapered from base to apex, apically twisted 10–20°; upper mandibular tooth slightly compressed, 1.8–2.1 times as long as the lower tooth; outer mandibular surface sparsely pubescent, centrally flat, and with a weak proximal concavity. Labrum 0.2–0.3 times as long as broad; malar space 0.2–0.5 times as long as basal mandibular width (males tend to have a longer malar space than females). Clypeus in profile flat or slightly out-flared, margin blunt to subacute; clypeus in front view 1.8–1.9 times as broad as long, its margin truncate. Lower face of ♀ 0.80–1.10, of ♂ 0.90–1.20 times as broad as long, centrally smooth and polished, with fine scattered punctures. Head in dorsal view with genae slightly inflated behind eyes; posterior ocellus close to or contiguous with eye; FI = 55–65%; occipital carina mediodorsally absent or weak, ventrally evanescent before joining the hypostomal carina. Antenna moderately long and slender, with 51–59 flagellar segments; 20th segment 1.5–1.8 times as long as broad, that of male tending to be more slender than that of the female Mesoscutum polished, punctate, in profile steeply rounded; notauli vestigial. Mesopleuron polished, punctate but sometimes with some punctostriation centrally; epicnemial carina weak, curved towards anterior margin of pleuron, but with upper end evanescent. Scutellum in profile moderately convex, laterally carinate for most of its length, but often with carinae weak; scutellum in dorsal view 1.4–1.5 times as long as anteriorly broad, generally rather smooth. Metapleuron moderately convex, weakly punctostriate; submetapleural carina slightly broadened anteriorly; posterior transverse carina of mesosternum from complete to broadly indistinct centrally. Propodeum in profile abruptly declivous, dorsally deplanate; anterior transverse carina from complete to completely absent, posterior transverse carina present laterally as short crests; anterior area deeply impressed, striate; spiracular area short, almost smooth; posterior area weakly sculptured, with only a few weak concentric rugae dorsally; lateral longitudinal carina generally complete though occasionally weak posteriorly, not joined to spiracular margin by a short carina.

Fore wing length 10–15 mm; fore wing rather more sparsely hirsute than is normal for species in this genus; discosubmarginal cell as in Fig. 237; AI = 0.45–1.17; CI = 0.48–0.57; ICI = 0.39–0.70; SDI = 1.27–1.46; *cu-a* somewhat oblique, proximal to the base of *Rs&M* by about 0.1–0.2 times its own length; marginal cell proximally slightly more sparsely hirsute; 1st subdiscal cell sparsely hirsute. Hind wing with 7–10 hamuli on *R*1; 1st abscissa of *Rs* almost straight, 2nd abscissa weakly bowed.

Fore leg with tibia barely flattened, with scattered spines on outer surface. Mid leg with longer tibial spur 1.3–1.5 times length of the shorter. Hind leg with coxa in profile 1.5–1.7 times as long as deep; trochantellus dorsally <0.1 times as long as broad; 4th segment of tarsus 1.9–2.0 times as long as broad; claws of female long, weakly curved with close fine pectinae, those of male very similar.

Gaster moderately slender; tergite 2 in profile 2.8–3.5 times as long as posteriorly deep, laterotergite folded under, thyridia large, obovate, separated from anterior margin of tergite by about 1.5–2.0 times its own length. Ovipositor slender, its sheath narrow. Male with sternites 7–9 bearing fine semierect pubescence; gonosquama quite long, acutely rounded.

Colour generally yellowish brown, often with orbits and scutellum paler yellowish; interocellar area yellowish; antenna orange, distally slightly infuscate; pterostigma yellowish orange; wings hyaline.

VARIATION. *Enicospilus cushmani* is a morphologically rather uniform species. The most striking variation is in the degree of pubescence of the wings. Typically this pubescence is sparser than in other species, but in some specimens the central part of the fore wing bears very isolated, short hairs. Such specimens often tend to have slightly thickened veins.

REMARKS. *Enicospilus cushmani* has not been collected in any country south of the United States, and therefore does not strictly fall within the area of this study. However, it does occur in southern Florida in company with many Neotropical species, and it may occur further south. Furthermore, it is structurally quite similar to *E. texanus* and some other species that do occur in the region being studied. Therefore I have included it so that it may be differentiated from its relatives.

Enicospilus cushmani is probably very closely related to *E. texanus*. Both species have long, weakly curved tarsal claws (almost certainly a specialized characteristic), sexually dimorphic heads and subquadrate to transverse faces (two further probable synapomorphies). It is very easy to separate the typical specimens of *E. texanus* from *E. cushmani* since the former species is larger and has infumate wings. However, there are a few specimens of *E. texanus* (or possibly a very closely related, undescribed species that also parasitizes hemileucine saturniids) that have almost hyaline wings. The following features will enable them to be separated.

E. cushmani	*E. texanus*
Hairs in centre of fore wing sparse, separated by more than their own lengths	Hairs in centre of fore wingclose together, separated by less than their own lengths
Lateral longitudinal carina of propodeum present behind anterior transverse carina	Lateral longitudinal carina of propodeum absent behind anterior transverse carina
Rs+2r tending to be evenly bowed between pterostigma and *3rs-m*	*Rs+2r* more sinuous, the part near to *3rs-m* more or less straight
Mandibles short and evenly tapered with upper tooth at least 1.8 times length of the lower	Mandibles long, distally parallel-sided, the upper less than 1.7 times length of lower
Parasitoids of Lymantriidae	Parasitoids of Saturniidae

E. cushmani also superficially resembles a Mexican species, *E. halffteri*, but the latter species has a narrower face and the claws more abruptly rounded.

BIOLOGICAL INFORMATION. *Enicospilus cushmani* is widely distributed throughout eastern North America, from Ontario south to Highlands county, Florida. It is a common parasitoid of the larvae of *Malacosoma americana* (Fabricius) and *M. disstria* (Hübner). *E. cushmani* appears to have a single generation per year. It flies as early as January in Florida, though it is most common in March/April and individuals have been collected as late as mid May. Further north it is most common in June. The parasitoid larva apparently kills its host before the caterpillar spins a cocoon. The ichneumonid emerges from its host larva and spins a thick fibrous ovoid cocoon 12–15 mm in length in which it pupates. This cocoon is more whitish and woolly externally than are the cocoons of many species of *Enicospilus*.

MATERIAL EXAMINED

Holotype ♀, **U.S.A.**: Florida, Alachua Co., Gainesville ii.1955 (*Patton*) (USNM).

Paratypes. 34 ♂, 61 ♀, **Canada** (Ontario); **U.S.A.** (Florida, Massachusetts, New Jersey) (BMNH, CNC, FSCA, TC, USNM) as detailed by Gauld (1988).

Enicospilus halffteri sp. n.

(Figs 97, 238)

DESCRIPTION. Mandibles moderately long, evenly tapered, apically twisted 10°; upper mandibular tooth slightly compressed, 1.8 times as long as the lower tooth; outer mandibular surface with a broad shallow proximal concavity, distally centrally rugulose. Labrum 0.3 times as long as broad; malar space 0.5 times as long as basal mandibular width. Clypeus in profile flat, margin quite sharp; clypeus in front view 1.5 times as broad as long, with its margin truncate. Lower face 0.86 times as broad as long, centrally obsoletely punctostriate. Head in dorsal view with genae slightly swollen (Fig. 97); posterior ocellus very close to eye; FI = 63%; occipital carina mediodorsally obsolescent, ventrally inclined towards hypostomal carina but with lower end absent. Antenna moderately slender, with 61 flagellar segments; 20th segment 2.1 times as long as broad.

Mesoscutum weakly polished with obsolescent punctures, in profile rather steeply rounded; notauli vestigial. Mesopleuron weakly polished, the upper part punctate, grading ventrally to punctostriate; epicnemial carina inclined towards anterior margin of pleuron, its upper end obsolescent. Scutellum in profile moderately convex, laterally carinate for 0.3 of its length; scutellum in dorsal view 1.4 times as long as anteriorly broad, anteriorly punctate, posteriorly longitudinally striate. Metapleuron strongly convex, coarsely and irregularly striate; submetapleural carina evenly anteriorly broadened; posterior transverse carina of mesosternum strong, with a broad V-shaped cleft centrally. Propodeum in profile fairly abruptly declivous; anterior transverse carina complete except at extreme lateral ends, posterior transverse carina absent; anterior area striate, spiracular area short, finely punctate; posterior area reticulate; lateral longitudinal carina present anteriorly, not joined to spiracular margin by a short carina.

Fore wing length 21 mm; discosubmarginal cell as in Fig. 238; AI = 0.56; CI = 0.46; ICI = 0.67; SDI = 1.34; *cu-a* proximal to base of *Rs&M* by about its own thickness; marginal cell proximally evenly hirsute; 1st subdiscal cell with anterior 0.5 hirsute. Hind wing with 11 hamuli on *R*1; 1st abscissa of *Rs* almost straight, 2nd abscissa straight.

Fore leg with tibia weakly flattened, with scattered spines on outer surface. Mid leg with longer tibial spur 1.4 times length of the shorter. Hind leg with coxa in profile 1.8 times as long as deep; trochantellus dorsally <0.1 times as long as broad; 4th segment of tarsus 1.9 times as long as broad; claws of male closely pectinate.

Gaster moderately slender; tergite 2 in profile 4.6 times as long as posteriorly deep, laterotergite folded under, thyridia elliptical and separated from anterior margin of tergite by about 2.5 times its own length. Female unknown. Male with sternites 7–9 bearing fine decumbent pubescence; gonosquama distally acute.

Colour generally pale yellowish, mesoscutum with obscure light brownish vittae, gaster posteriorly weakly infuscate; interocellar area yellow; antenna yellowish brown, infuscate at extreme apices; pterostigma golden; wings hyaline.

Variation. A second specimen from Chiapas differs from the holotype in being larger (fore wing length 24 mm), having the scutellum more convex, the metapleuron ventrally flattened, the gaster infuscate and the wings infumate. It is only tentatively associated with this species.

Remarks. This species is named in honour of Dr Gonzalo Halffter, who has done so much to further conservation biology in Mexico

E. halffteri belongs to a complex of species that have *Rs+2r* weakly sinuous. However, the absence of well-developed scutellar carinae enable *E. halffteri* to be distinguished easily from the other species. In venation, coloration and general appearance *E. halffteri* closely resembles *E. aktites*. However, the genae of *E. aktites* are narrower and the propodeum is posterodorsally concentrically striate; in *E. halffteri* the propodeum is posterodorsally reticulate. Furthermore, the pubescence on the male posterior sternites is finer and more decumbent in *E. halffteri*.

Biological Information. *Enicospilus halffteri* is only known to occur in the southern Mexican state of Chiapas. A tentatively associated specimen was taken in cloud forest.

Material Examined

Holotype ♂, **Mexico**: Chiapas, junction of highways 190–195, 6.vi.1969 (*Howden*) (CNC).

Non-paratypic material. **Mexico**: Chiapas: 1 ♂, Santa Rosa, cloud forest, 1260 m, v.1967 (*Halffter & Reyes*) (CNC).

Enicospilus sarukhani sp. n.

(Figs 96, 239)

Description. Mandibles moderately long, rather evenly tapered, apically twisted 20–25°; upper mandibular tooth subcylindrical to slightly compressed, 1.3–1.5 times as long as the lower tooth; outer mandibular surface with fine close pubescence, centrally flat, and with a weak proximal concavity. Labrum 0.3 times as long as broad; malar space 0.3 times as long as basal mandibular width. Clypeus in profile flat, margin subacute; clypeus in anterior aspect 1.4–1.5 times as broad as long, the margin weakly convex apically. Lower face 0.72–0.80 times as broad as long, centrally obsoletely punctate. Head in dorsal view with genae rounded behind eyes (Fig. 96); posterior ocellus contiguous with eye; FI = 65–70%; occipital carina mediodorsally weak or obsolescent, ventrally evanescent, not curved to join hypostomal carina. Antenna rather stout, with 65–66 flagellar segments; 20th segment 1.5 times as long as broad.

Mesoscutum polished, finely punctate, in profile abruptly rounded; notauli obsolescent. Mesopleuron polished, the upper part punctate, the lower part punctate or punctostriate; epicnemial carina with upper end curved towards anterior margin of pleuron. Scutellum in profile quite strongly convex, laterally carinate for most of its length; scutellum in dorsal view 1.4 times as long as anteriorly broad, anteriorly matt, with fine punctures amongst weak rugae, posteriorly becoming strongly longitudinally rugose, with central part slightly raised into a weak crest; postscutellum exceptional in being centrally raised and bearing a weak to strong longitudinal crest. Metapleuron convex, rather smooth and polished, with fine punctures; submetapleural carina quite strongly anteriorly broadened; posterior transverse carina of mesosternum complete. Propodeum in profile fairly abruptly declivous; anterior transverse carina complete, sinuous, posterior transverse carina present as strong lateral vestiges; anterior area long, smooth with isolated striae and together with the smooth spiracular area forming a broad shallow depression; posterior area deplanate, with anterior 0.3 behind anterior transverse carina smooth, the part behind this smooth except for a few scattered rugae; lateral longitudinal carina present anteriorly, not joined to spiracular margin by a short carina.

Fore wing length 23–24 mm; discosubmarginal cell as in Fig. 239; AI = 0.89–0.94; CI = 0.43–0.51; ICI = 0.66–0.80; SDI = 1.44–1.61; *cu-a* proximal to base of *Rs&M* by 0.1–0.2 times its own length; marginal cell proximally more or less evenly hirsute; 1st subdiscal cell with anterior and distal sides hirsute. Hind wing with 9–11 hamuli on *R*1; 1st abscissa of *Rs* almost straight, 2nd abscissa almost straight.

Fore leg with tibia slightly flattened, with few scattered spines on outer surface. Mid leg with longer tibial spur 1.4 times length of the shorter. Hind leg with coxa in profile 1.6–1.7 times as long as deep; trochantellus dorsally <0.1 times as broad; 4th segment of tarsus 2.2–2.3 times as long as broad; claws of female large, strongly curved with close pectinae.

Gaster slender; tergite 2 in profile 6.0–6.3 times as long as posteriorly deep, laterotergite turned under, thyridia elliptical and separated from anterior margin of tergite by about 3 times its own length. Ovipositor slender, its sheath narrow. Male unknown.

Colour generally yellowish brown, with head paler yellowish, gaster with tergites 3+ infuscate; interocellar area yellowish or whitish; antenna and pterostigma golden; wings hyaline.

VARIATION. The specimen from California has *Rs+2r* basally slightly more incrassate than occurs in the Mexican material.

REMARKS. This species is named in honour of Dr José Sarukhan, who has done so much for the development of field biology in Mexico.

Enicospilus sarukhani belongs to the complex of species that are characterized by the possession of an almost straight *Rs+2r*. Within this complex it may be recognized by the combination of the specialized postscutellum and the smooth propodeum. The metapleuron is much smoother and polished than that of other species with a fairly straight *Rs+2r*.

BIOLOGICAL INFORMATION. *Enicospilus sarukhani* has been taken at high altitude sites between 2300 and 3000 m in Mexico, and a single female has been collected near San Diego, California in the United States.

MATERIAL EXAMINED

Holotype ♀, **Mexico**: Durango, 16 km W. El Salto, 3000 m, vii.1964 (*Martin*) (CNC).

Paratypes. **Mexico**: Hidalgo: 1 ♀, San Vicente, 2300 m, vi.1963 (*Woodruff*) (FSCA). **U.S.A.**: California: 1 ♀, San Diego (USNM).

Enicospilus aktites Gauld

(Figs 161, 240)

Enicospilus aktites Gauld, 1988: 36. Holotype ♀, COSTA RICA (BMNH) [examined.]

DESCRIPTION. Mandibles moderately long, strongly narrowed so apex is slender, apically twisted 15–20°; upper mandibular tooth subcylindrical, 1.2–1.4 times as long as the lower tooth; outer mandibular surface with a broad shallow proximo-ventral concavity. Labrum 0.2–0.3 times as long as broad; malar space 0.2–0.3 times as long as basal mandibular width. Clypeus in profile flat or very weakly convex, margin blunt; clypeus in front view 1.2–1.4 times as broad as long, its margin truncate. Lower face 0.65–0.72 times as broad as long, centrally with distinct fine punctures. Head in dorsal view with genae rounded behind eyes; posterior ocellus contiguous with eye; FI = 65–70%; occipital carina mediodorsally complete, ventrally not reaching hypostomal carina. Antenna moderately slender, with 55–62 flagellar segments; 20th segment 1.3–1.7 times as long as broad.

Mesoscutum weakly polished, closely but shallowly punctate, in profile abruptly rounded; notauli vestigial. Mesopleuron polished, punctostriate, grading more towards striate ventrally; epicnemial carina inclined towards anterior margin of pleuron. Scutellum in profile weakly to moderately convex, laterally carinate for all of its length; scutellum in dorsal view 1.3–1.5 times as long as anteriorly broad, anteriorly smooth, posteriorly rugulose. Metapleuron convex, generally punctate or coarsely punctostriate, exceptionally granulate; submetapleural carina generally evenly anteriorly broadened; posterior transverse carina of mesosternum complete or centrally obsolescent. Propodeum in profile abruptly declivous; anterior transverse carina complete, usually centrally raised, occasionally laterally absent; posterior transverse carina from absent to present laterally as a vestige; anterior area short, striate or rarely smooth;

spiracular area short, punctate finely; posterior area rugose, the rugae tending to be concentric posterodorsally (Fig. 161); lateral longitudinal carina present at least anteriorly, not joined to spiracular margin by a short carina.

Fore wing length 13–17 mm; discosubmarginal cell as in Fig. 240; AI = 0.69–1.21; CI = 0.36–0.53; ICI = 0.70–1.02; SDI = 1.15–1.32; *cu-a* from subopposite base of *Rs&M* to proximal to it by 0.3 times its own length; marginal cell proximally more or less evenly hirsute except for narrow glabrous band adjacent to *Rs+2r*; 1st subdiscal cell with anterior 0.3–0.5, and posterodistal corner hirsute. Hind wing with 5–9 hamuli on *R*1; 1st abscissa of *Rs* almost straight, 2nd abscissa straight.

Fore leg with tibia slightly flattened, with a few strong spines on outer surface. Mid leg with longer tibial spur 1.3–1.5 times length of the shorter. Hind leg with coxa in profile 1.6–1.7 times as long as deep; trochantellus dorsally <0.1 times as long as broad; 4th segment of tarsus 2.0–2.4 times as long as broad; claws of female large, with short close pectinae, those of male similar.

Gaster slender; tergite 2 in profile 3.4–5.1 times as long as posteriorly deep, laterotergite turned under, thyridia small, obovate and separated from anterior margin of tergite by about 4–5 times its own length. Ovipositor slender, its sheath narrow. Male with sternites 7–9 bearing long stout erect hairs; gonosquama apically acute.

Colour generally pale yellowish, mesoscutum with weak brownish vittae, gaster slightly infuscate; interocellar area yellowish; antenna golden; pterostigma golden; wings hyaline.

VARIATION. *Enicospilus aktites* is a morphologically rather uniform species except that the larger specimens tend to have the metapleurae more strongly punctate than in smaller individuals. All specimens have a quite distinct and elongate quadra present in the fenestra, but a number of individuals have a second weak quadra paralleling this.

REMARKS. *Enicospilus aktites* belongs to a complex of species that are characterized by the possession of an almost straight *Rs+2r*. This complex includes *E. aktites*, *E. abelardoi*, *E. hallwachsae*, *E. halffteri* and *E. sarukhani*. Of these species *E. abelardoi* can easily be distinguished by its pyramidal scutellum and large size, and *E. halffteri* is recognizable because it lacks well-developed scutellar carinae. *E. sarukhani* is distinctive in having an anteriorly smooth posterior propodeal area. *E. aktites* most closely resembles the Mesoamerican species *E. hallwachsae*. Both have similarly modified, rather slender mandibles and large values for AI and ICI, suggesting they may be closely related. *E. hallwachsae* does not have a distinctly thickened quadra, is darker than *E. aktites*, and has a more elongate 2nd discal cell

BIOLOGICAL INFORMATION. *Enicospilus aktites* is a very common species in Santa Rosa National Park where individuals have been collected during all months of the year. Pooled data for 1980–5 are:

J	F	M	A	M	J	J	A	S	O	N	D
4	2	12	2	10	12	6	5	5	6	5	7

Elsewhere this species is apparently very uncommon. I have seen two individuals from Cerro el Hacha, in Guanacaste National Park. Apart from these, and a single specimen collected at Monteverde, Costa Rica in 1962 (and intensive subsequent collecting has failed to find any more examples of this species at this locality) all other (3) specimens have been collected at coastal sites (Map 10). The Guanacaste National Park/Santa Rosa site is within 8 km of the coast, so possibly this species is normally restricted to drier coastal areas and dry forests adjacent to such sites.

MATERIAL EXAMINED

Holotype ♀, **Costa Rica**: Guanacaste Prov.: Santa Rosa National Park, 300 m, light-trap overlooking deciduous forest, vi.1985 (*Gauld*) (BMNH)

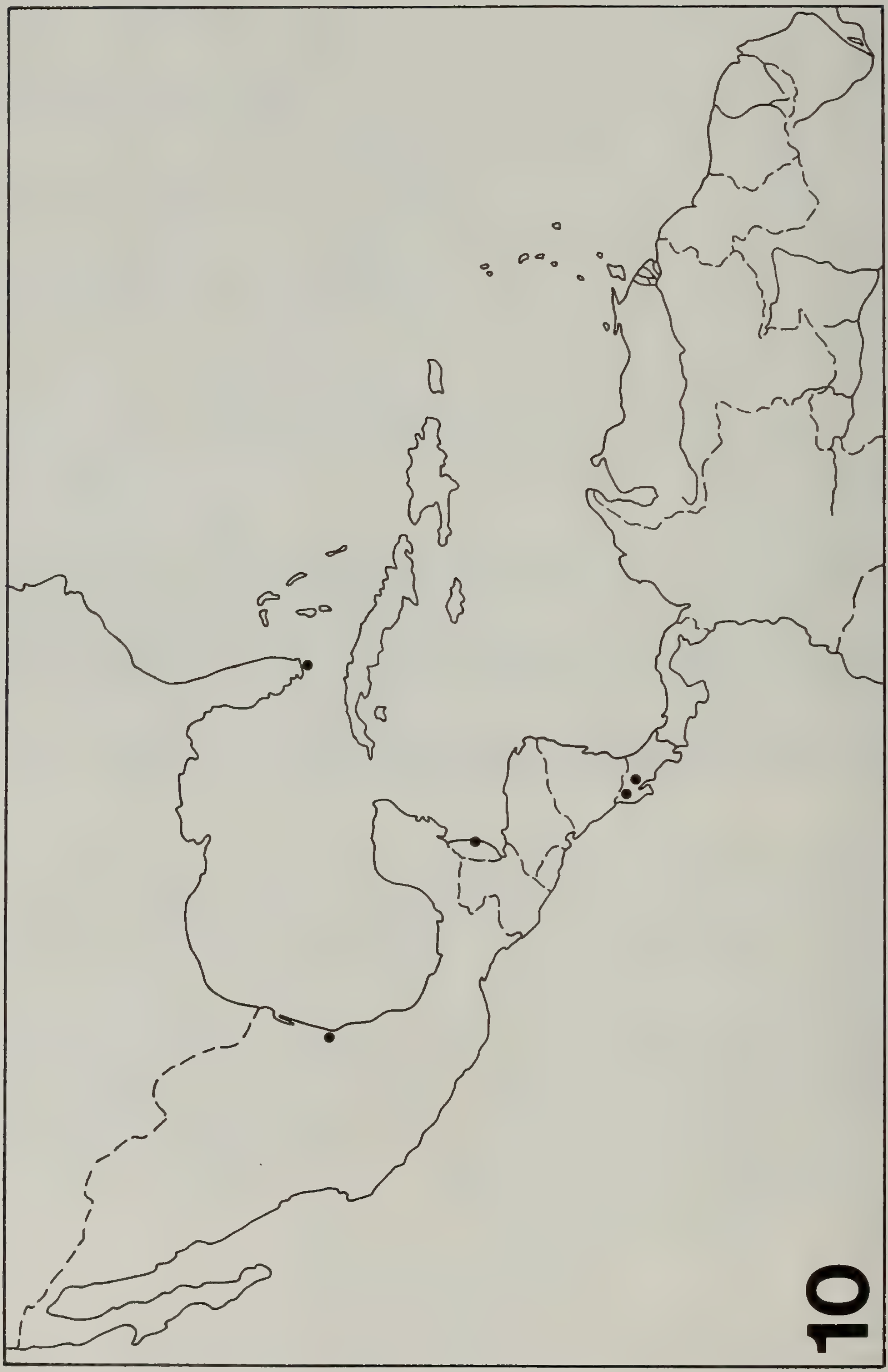
Paratypes. **Belize**: 1 ♂, Punta Gorda, x.1913 (*Norton*) (BMNH). **Costa Rica**: Guanacaste Prov.: 27 ♂, 48 ♀, Santa Rosa National Park, 300 m, months as enumerated above, 1980–85 (*Janzen & Hallwachs*) (BMNH, CNC, TC, USNM): Puntarenas Prov.: 1 ♀, Monteverde, ii.1962 (*Palmer*) (TC). **Mexico**: Tamaulipas: 1 ♀, Municip. de Aldama, Barra Coma, v.1979 (*Gicca*) (FSCA). **U.S.A.**: Florida: 1 ♂, Monroe Co., No Name Key, vi.1974 (*Heppner*) (FSCA).

Non-paratypic material. **Costa Rica**: Guanacaste Prov.: 1 ♂, 1 ♀, Guanacaste National Park, Cerro el Hacha, 400 m, x-xi.1987 (*Chacon*) (BMNH).

Enicospilus gomezpompai sp. n.

(Figs 162, 241)

DESCRIPTION. Mandibles moderately long, proximally abruptly narrowed, distally rather slender and parallel-sided, apically twisted 10–20°; upper mandibular tooth very slightly compressed, 1.4–1.6 times as long as the lower tooth; outer mandibular surface with fine, scattered pubescence, almost flat centrally,



Map 10 Localities at which *Enicospilus aktites* has been collected.

and with a shallow proximal concavity. Labrum 0.2 times as long as broad; malar space 0.2–0.3 times as long as basal mandibular width. Clypeus in profile from almost flat to weakly convex, margin blunt to subacute; clypeus in front view 1.4–1.6 times as broad as long, its margin weakly convex. Lower face 0.69–0.74 times as broad as long, centrally with obsolescent punctures. Head in dorsal view with genae rounded behind eyes; posterior ocellus contiguous with eye; FI = 70–75%; occipital carina mediodorsally complete, usually weak, sometimes very faint and obsolescent, ventrally evanescent, not joining hypostomal carina. Antenna long and slender, with 64–66 flagellar segments; 20th segment 1.8–2.0 times as long as broad.

Mesoscutum weakly polished with fine punctures, in profile steeply rounded; notauli vestigial. Mesopleuron polished, the upper part punctate ventrally grading to punctostriate; epicnemial carina with upper end weak but curved towards anterior margin of pleuron. Scutellum in profile weakly convex, laterally carinate for 0.7 or more of its length; scutellum in dorsal view 1.5–1.6 times as long as anteriorly broad, anteriorly punctate with microreticulations, posteriorly slightly rugose. Metapleuron weakly convex with fine punctures on a generally weakly shagreened surface; submetapleural carina usually evenly anteriorly broadened; posterior transverse carina of mesosternum complete. Propodeum in profile abruptly declivous; anterior transverse carina weak but usually complete, posterior transverse carina vestigial; anterior area quite long, with a few wrinkles but not striate; spiracular area short, smooth; posterior area dorsally deplanate, with weak irregular sculpture (Fig. 162); lateral longitudinal carina present only as a vestige anteriorly, not joined to spiracular margin by a short carina.

Fore wing length 17–22 mm; discosubmarginal cell as in Fig. 241; AI = 0.42–0.75; CI = 0.55–0.66; ICI = 0.49–0.55; SDI = 1.28–1.35; *cu-a* proximal to the base of *Rs&M* by 0.1–0.3 times its own length; marginal cell proximally very narrowly glabrous; 1st subdiscal cell anteriorly and distally sparsely hirsute. Hind wing with 8–11 hamuli on *R*1; 1st abscissa of *Rs* straight, 2nd abscissa weakly bowed.

Fore leg with tibia weakly flattened, with scattered spines on outer surface. Mid leg with longer tibial spur 1.3–1.4 times length of the shorter. Hind leg with coxa in profile 1.7–1.8 times as long as deep; trochantellus dorsally <0.1 times as long as broad; 4th segment of tarsus 2.4–2.6 times as long as broad; claws of female strongly curved, with long stout pectinae, those of male similar but with pectinae slightly finer.

Gaster slender; tergite 2 in profile 5.5–6.0 times as long as posteriorly deep, laterotergite folded under, thyridia elliptical and separated from anterior margin of tergite by about 2.5–3.5 times its own length. Ovipositor slender, its sheath narrow. Male with sternites 7–9 bearing fine, erect hairs; gonosquama long, distally evenly rounded.

Colour generally pale yellowish brown, head yellow, mesoscutum centrally weakly infuscate; interocellar area yellow; antenna golden; pterostigma golden; wings hyaline.

VARIATION. The specimens from Cordoba, Veracruz and Lagos des Calores, Chiapas differ from the series collected in Guerrero in that tergites 3+ of the gaster are somewhat infuscate. A second specimen from Chiapas differs from the other material in being very much darker, with blackish antennae and gaster and dark brownish alitrunk. This specimen has the metapleuron more punctate than normal and the mandibles more twisted. The male from Veracruz has the propodeum more coarsely sculptured than normal and the U-shaped alar sclerite is very weak.

REMARKS. This species is named in honour of Dr Arturo Gomez-Pompa, who has aggressively developed Mexican biology for more than two decades.

Enicospilus gomezpompai may most easily be recognized by the possession of a very large fenestra bounded by a weak, almost U-shaped vestigial sclerite. The subgenital plate of the female is larger than in many allied species.

I have excluded the dark specimen from the paratype series as I am not convinced it is conspecific. However, with only a single specimen to hand any other placement would also have been uncertain and in this complex of closely related species conservatism at the species-level is essential

BIOLOGICAL INFORMATION. *Enicospilus gomezpompai* has only been collected at moderately high altitude in southern Mexico. Nothing is known about its biology.

MATERIAL EXAMINED

Holotype ♀, **Mexico**: Guerrero, Amula, 2000 m, viii.1904 (*Smith*) (BMNH).

Paratypes. **Mexico**: Chiapas: 1 ♀, Rt 17, Lagos des Calores, v.1969 (*Howden*) (CNC): Guerrero: 1 ♂, 3 ♀, Amula, 2000 m, viii, ix.1904 (*Smith*) (BMNH); 1 ♀, Xucumanatlan, 2300 m, vii.1904 (*Smith*) (BMNH): Veracruz: 1 ♂, Cordoba, x.1963 (*Lau*) (RNH).

Non-paratypic material. **Mexico**: Chiapas: 1 ♀, San Cristobal de las Casas, v.1964 (*Martin*) (CNC).

Enicospilus lebophagus Gauld

(Figs 163, 242)

Enicospilus lebophagus Gauld, 1988: 45. Holotype ♀, COSTA RICA (BMNH) [examined].

Description. Mandibles of moderate length, proximally strongly narrowed, distally more weakly so, apically twisted 15–25°; upper mandibular tooth subcylindrical, 1.2–1.5 times as long as the lower tooth; outer mandibular surface finely and sparsely hirsute, though more densely hirsute on proximoventral lobe; outer surface flat centrally, with a broad, shallow proximal concavity. Labrum 0.2–0.3 times as long as broad; malar space 0.3–0.4 times as long as basal mandibular width. Clypeus in profile flat, at very most only slightly out-flared, margin blunt; clypeus in front view truncate or weakly convex apically, 1.4–1.6 times as broad as long. Lower face 0.66–0.88 times as broad as long, centrally polished, virtually smooth. Head in dorsal view with genae short, rounded behind the eyes; posterior ocellus contiguous with eye; FI = 70–80%; occipital carina mediodorsally from complete to narrowly interrupted, ventrally curved to approach, but not actually join hypostomal carina about 1.0 times the basal mandibular width away from mandible. Antenna long and quite slender, with 60–67 flagellar segments; 20th segment 1.6–2.0 times as long as broad.

Mesoscutum polished, finely punctate, in profile evenly rounded; notauli very shallow, but extending back to level of hind corner of pronotum. Mesopleuron polished, the upper part punctate to punctostriate, the lower part punctostriate to striate; epicnemial carina with upper end weak, curved towards anterior margin of pleuron. Scutellum in profile moderately convex, laterally carinate for 0.8 or more of its length; scutellum in dorsal view 1.3–1.5 times as long as anteriorly broad, anteriorly generally relatively smooth with weak to very strong longitudinal striae developed posteriorly. Metapleuron moderately convex, varying considerably in sculpture from punctate or punctostriate to rugulose; submetapleural carina quite narrow, not or only slightly broadened anteriorly; posterior transverse carina of mesosternum from complete to with central part effaced. Propodeum in profile rather abruptly declivous, posterodorsally deplanate; anterior transverse carina usually complete, posterior transverse carina present only as a vestigial keel; anterior area deeply impressed, striate, spiracular area short and smooth or punctate, posterior area coarsely rugose to rugose-reticulate, often with the rugae concentric posteriorly; lateral longitudinal carina present anteriorly, and often extending back for half the length of the propodeum, not joined to spiracular margin by a short carina.

Fore wing length 20–25 mm; discosubmarginal cell as in Fig. 242; AI = 0.77–1.61; CI = 0.55–0.74; ICI = 0.60–0.90; SDI = 1.35–1.61; *cu-a* proximal to the base of *Rs&M* by 0.1–0.3 times its own length; marginal cell proximally fairly evenly hirsute, at most with a narrow glabrous band adjacent to *Rs+2r*; 1st subdiscal cell with at least the anterior 0.3 hirsute, often almost entirely hirsute except for the posteroproximal part. Hind wing with 9–13 hamuli on *R*1; 1st abscissa of *Rs* straight to weakly bowed, 2nd abscissa almost straight.

Fore leg with tibia weakly flattened, with numerous scattered spines on outer surface. Mid leg with longer tibial spur 1.1–1.2 times length of the shorter. Hind leg with coxa in profile 1.7–1.8 times as long as deep; trochantellus dorsally <0.1 times as long as broad; 4th segment of tarsus 2.8–3.0 times as long as broad; claws of female long, abruptly curved with long, strong close pectinae, those of male similar but with pectinae slightly shorter and closer together.

Gaster moderately slender; tergite 2 in profile 3.5–4.0 times as long as posteriorly deep, laterotergite folded under, thyridia oval to obovate and separated from anterior margin of tergite by about 2–4 times its own length. Ovipositor slender, its sheath narrow. Male with sternites 7–9 bearing moderately long, very stout erect hairs (Fig. 163); gonosquama apically subacute.

Colour generally orange-brown, sometimes with the orbits yellow; interocellar area orange; antenna brownish orange; pterostigma orange; wings hyaline or weakly infumate.

Variation. Morphologically this is a very uniform species. Occasional individuals may have the gaster slightly infuscate, but I have not seen a single specimen with the gaster black posteriorly. All specimens have two thickened patches (quadrae) in the alar fenestra, but the degree to which these are pigmented is somewhat variable. A single, possibly conspecific female from Barro Colorado, has rather short mandibles.

Remarks. *Enicospilus lebophagus* is a large species that has frequently been confused with *E. americanus*, which it closely resembles in size and general appearance. However, the two differ consistently in a number of morphological features, are apparently allopatric and have different hosts. The following table contrasts the critical characters of the two taxa.

E. lebophagus	*E. americanus*
Genae evenly rounded behind eyes	Genae barely narrowed behind eyes
Sternites 6–9 of male bearing numerous stout truncated erect hairs	Sternites 6–9 of male bearing scattered fine erect hairs, or hairs with close stout hairs (var. 1)
Fenestra with two distinct quadrae	Fenestra without quadrae, or with an indistinct one
Clypeus weakly out-flared or flat, even in large specimens	Clypeus usually strongly out-flared, in small specimens almost flat
Flagellum slender, central segments 1.6–2.0 times as long as centrally broad	Flagellum stout, central segments 1.4–1.7 times as long centrally broad

Biological Information. *Enicospilus lebophagus* occurs in the extreme south of Texas in Cameron and Hidalgo counties, and thence southwards throughout Central America to northern Costa Rica (Map 11). I have examined extensive collections from Panama and southern Costa Rica, but I have only found one questionable specimen of this species to occur south of about 11°N. In Santa Rosa National Park, Costa Rica, this species has been taken at light in the following months (cumulative total 1979–1985)

J	F	M	A	M	J	J	A	S	O	N	D
–	–	–	–	2	11	2	2	1	1	–	1

It is a common solitary endoparasitoid of the larvae of *Rothschildia lebeau lebeau* (Guérin-Méneville) and *R. lebeau forbesi* (Benjamin). Oviposition is apparently into a relatively mature larva and the ophionine destroys its host caterpillar after the host has constructed a cocoon. The *Enicospilus* cocoon is a typical ovoid ophionine cocoon, but it is spun within the cocoon of the saturniid. The adult parasitoid emerges by pushing out through the cocoon entrance, just as does the adult moth.

Material Examined

Holotype ♀, **Costa Rica**: Guanacaste Prov.: Santa Rosa National Park, 300 m, ex *Rothschildia lebeau*, 83.SRNP.123 (*Janzen*) (BMNH)

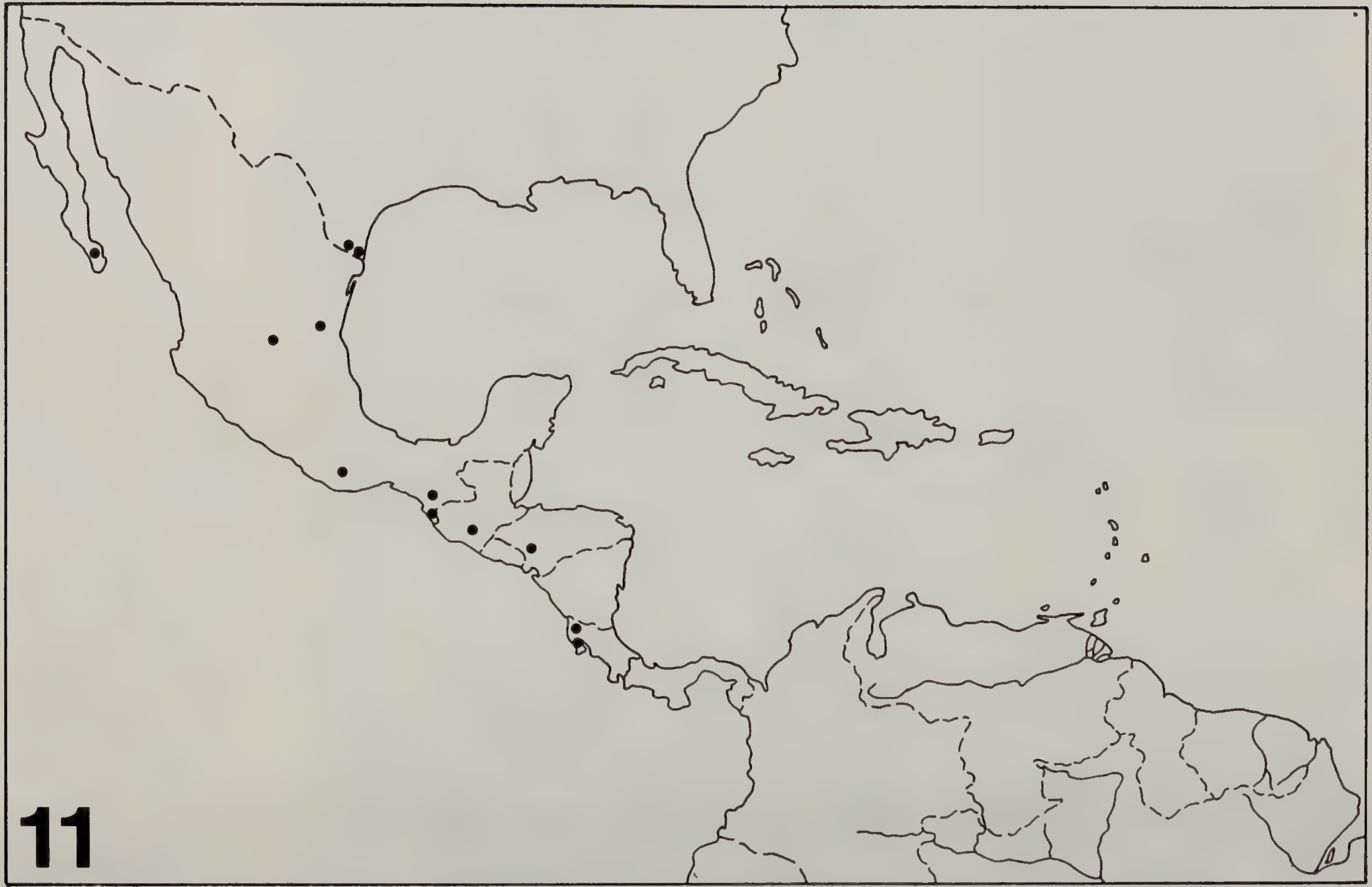
Paratypes. **Costa Rica**: Guanacaste Prov: 1 ♂, W. of Carmona Nicoya, 6–700 m, viii.1982 (*Janzen & Hallwachs*) (BMNH); 30 ♂, 37 ♀, Santa Rosa National Park, 300 m, ex *Rothschildia lebeau* 1979–1985 (*Janzen*) (BMNH, CAS, CNC, MCZ, PANS, TC, USNM); 1 ♂, 1 ♀, same locality, v.1979 (*Janzen*) (TC); 1 ♀, vi.1979 (*Janzen*) (BMNH); 1 ♂, 1 ♀, vi.80; 2 ♀, viii.1980; 1 ♀, vii.1981; 1 ♀, vi.1982; 1 ♂, vii.1982; 1 ♂, x.1982; 1 ♀, xii.1982; 1 ♀, vi.1983; 1 ♂, ix.1983; 3 ♀, vi.1984; 1 ♂, 1 ♀, vi.1985 (*Janzen & Hallwachs*) (BMNH); 1 ♂, vi.1985 (*Gauld*) (BMNH). **Guatemala**: 1 ♀, Solola, 5 km NE. Panajachel, 1740 m, viii.1975 (*Fisher*) (CAS). Honduras: 1 ♂, Trujillo, vii.1968 (*Dozier*) (FSCA). **Mexico**: Baja California: 1 ♂, 10 km W. Santiago, viii.1959 (*Radford & Werner*) (CAS): Chiapas: 1 ♂, 2 ♀, 30 km N. Huixtla, 1000 m, vi.1969 (*Mason & Peterson*) (CNC); 1 ♀, 20 km SW. El Salto, 2300 m, vii.1964 (*Madson*) (CNC): Guerrero: 1 ♂, 1 ♀, Xucumanatlan, 2300 m, vii.1904 (*Smith*) (BMNH): San Luis Potosí: 1 ♂, 1 ♀, El Salto Falls, vi.1963 (*Woodruff*) (FSCA): Tamaulipas: 1 ♂, Hacienda Sta Eugracra, vii.1939 (*Haag*) (MCZ): 2 ♀, 'Mexico', no further data (MCZ). **U.S.A.**: Texas: 1 ♀, Brownsville, x.1916 (*Vickery*) (PANS); 3 ♀, Harlingen, ex *Rothschildia lebeau forbesi*, em. 111.1981, v.1981, x.1981 (*Peigler*) (BMNH); 1 ♂, Hidalgo Co., Bentsen-Rio Grande State Park, ex *R. l. forbesi* em. x.1981 (*Peigler*) (BMNH); 1 ♂, 2 ♀, Hidalgo Co. south, ex *R. l. forbesi*, em. ii.1980 (indoors) (*Agnew & Eger*) (BMNH); 1 ♀, same data, em. ix.1980 (*Eger*) (BMNH).

Non-paratypic material. **Panama**: 1 ♀, Barro Colorado Island, vi.1978 (*Wolda*) (RNH).

Enicospilus ugaldci sp. n.

(Figs 164, 243)

Description. Mandibles moderately long, proximally strongly narrowed, distally weakly tapered, apically twisted 15–25°; upper mandibular tooth slightly compressed, 1.3–1.5 times as long as the lower tooth; outer mandibular surface with fine sparse hair, more or less flat centrally, with a weak proximal concavity. Labrum 0.2–0.3 times as long as broad; malar space 0.3 times as long as basal mandibular width. Clypeus in profile flat to somewhat out-flared, margin flat, subacute; clypeus in front view 1.3–1.5 times as broad as long, the margin truncate to slightly concave (Fig. 164). Lower face 0.71–0.78 times as broad as long, centrally weakly punctate, rarely punctostriate. Head in dorsal view with gena rounded behind the eyes; posterior ocellus contiguous with eye; FI = 60–65%; occipital carina mediodorsally from complete to



Map 11 Localities at which *Enicospilus lebophagus* has been collected.

narrowly interrupted, ventrally not curved to, but very nearly reaching or actually joining the hypostomal carina about 0.9 times the basal mandibular width away from mandible. Antenna long and slender, with 61–71 flagellar segments; 20th segment 2.1–2.3 times as long as broad.

Mesoscutum polished, with close shallow punctures, in profile evenly rounded, notauli vestigial. Mesopleuron polished, the upper part weakly punctostriate, the lower part more strongly punctostriate, sometimes almost punctoreticulate; epicnemial carina with upper end curved towards but not reaching anterior margin of pleuron. Scutellum in profile weakly convex, laterally carinate for all of its length; scutellum in dorsal view 1.4–1.6 times as long as anteriorly broad, anteriorly smooth but strongly longitudinally wrinkled posteriorly. Metapleuron moderately convex, matt, punctogranulate with traces of striae; submetapleural carina evenly anteriorly broadened; posterior transverse carina of mesosternum slightly sinuous, complete. Propodeum in profile abruptly declivous; anterior transverse carina complete, posterior transverse carina absent; anterior area short, deep, striate; spiracular area short and more or less smooth; posterior area, deplanate, coarsely rugose/reticulate, posteriorly with rugae tending to be concentric; lateral longitudinal carina present anteriorly, not joined to spiracular margin by a short carina.

Fore wing length 17–19 mm; discosubmarginal cell as in Fig. 243; AI = 0.74–1.05; CI = 0.49–0.55; ICI = 0.58–0.74; SDI = 1.39–1.45; *cu-a* proximal to the base of *Rs&M* by 0.1 or more times its own length; marginal cell proximally virtually glabrous adjacent to *Rs+2r*; 1st subdiscal cell anteriorly and posterodistally hirsute. Hind wing with 8–10 hamuli on *R*1; 1st abscissa of *Rs* straight, 2nd abscissa weakly bowed.

Fore leg with tibia slightly flattened, with scattered spines on outer surface. Mid leg with longer tibial spur 1.2–1.4 times length of the shorter. Hind leg with coxa in profile 1.7–1.8 times as long as deep; trochantellus dorsally <0.1 times as long as broad; 4th segment of tarsus 2.4–2.8 times as long as broad; claws of female long, strongly curved with long stout pectinae, those of male similar.

Gaster slender; tergite 2 in profile 5.2–6.2 times as long as posteriorly deep, laterotergite folded under, thyridia obovate to rather broadly elliptical, separated from anterior margin of tergite by about 3–4 times its own length. Ovipositor slender, its sheath narrow. Male with sternites 7–9 bearing long stout erect hairs; gonosquama distally evenly rounded.

Colour generally brownish orange with head, scutellum and sometimes also with mesoscutal stripes yellowish, gaster irregularly weakly infuscate, unusual in having the ovipositor sheaths brownish yellow, at most slightly infuscate apically; interocellar area yellow; antenna orange; pterostigma golden; wings hyaline.

VARIATION. One specimen from Chiapas is paler than the others. It has pronounced dark vittae on the mesoscutum. A male from Volcán Orosi, Costa Rica resembles other specimens of this species in the structure of the mandible and clypeus, having a broad face, and in general sculpture, but differs in having the fenestra somewhat shorter. It is tentatively included here, but excluded from the paratype series.

REMARKS. This species is named in honour of Señor Ugalde, the first director of Santa Rosa National Park, a person who has devoted his life to the growth of Costa Rica's national park system.

Enicospilus ugaldei belongs to the *E. americanus* species-complex. It may be distinguished from other taxa by the long fenestra which extends nearly to the base of *Rs*, and by the long sinuation on *Rs+2r*. The clypeus of this species is very subtly (but invariably) different from other species in this complex in being either truncate, or more usually slightly convex. The clypea of most species are very slightly convex in anterior aspect. Another unusual feature of this species is that the lower end of the genal (occipital) carina virtually meets or actually joins the hypostomal carina. In most species of the *E. americanus* complex the lower end of the genal carina is evanescent and it does not reach the hypostomal carina.

BIOLOGICAL INFORMATION. *Enicospilus ugaldei* is an uncommon Mesoamerican species whose range extends from central Mexico south to north-western Costa Rica. It has been reared once by D. H. Janzen in Santa Rosa National Park from the hemileucine saturniid *Automeris tridens* (Herrich-Schaeffer) (81.SRNP.892) (known in older literature as *A. rubrescens* (Walker)). This moth, whose larvae feed on a variety of conspicuous trees (see Janzen, 1982), is one the most common species of *Automeris* in Santa Rosa, and though it has often been reared only a single instance of parasitism by *E. ugaldei* has been observed.

MATERIAL EXAMINED

Holotype ♂, **Costa Rica**: Guanacaste Prov., Santa Rosa National Park, ex *Automeris tridens*, 1981 (*Janzen & Hallwachs*) (BMNH).

Paratypes. **Costa Rica**: Guanacaste Prov.: 1 ♀, Cerro el Hacha, 3–400 m, xi.1986-i.1987 (*Janzen & Hallwachs*) (BMNH); 1 ♂, Cerro el Hacha, Casa Oeste, 400 m, x.1987 (*Chacon*) (BMNH); 1 ♂, Santa Rosa National Park, 300 m, xii.1980 (*Janzen & Hallwachs*) (BMNH). **Mexico**: Chiapas: 1 ♀, 40 km N. of Huixtla, 1000 m, vi.1969 (*Peterson*) (CNC); 1 ♀, Huixtla, Muste, 440 m, ix.1970 (*Welling*) (CNC):

Quintana Roo: 1 ♀, X-can, viii.1963 (*Welling*) (CNC): San Luis Potosí: 2 ♂, El Salto Falls, vi.1963 (*Woodruff*) (FSCA).

Non-paratypic material. **Costa Rica**: 1 ♂, Guanacaste Prov.: Volcán Orosi, Casa Mariksa [Maritza], 700 m, v.1986 (*Gauld*) (BMNH).

Enicospilus umanai sp. n.

(Figs 165, 244)

Description. Mandibles moderately long, proximally abruptly narrowed, distally more or less parallel-sided, apically twisted 20–25°; upper mandibular tooth subcylindrical to slightly compressed, 1.3–1.5 times as long as the lower tooth; outer mandibular surface bearing fine sparse hairs, almost flat. Labrum 0.2–0.3 times as long as broad; malar space 0.3 times as long as basal mandibular width. Clypeus in profile very weakly convex, margin flat, subacute; clypeus in front view 1.5–1.7 times as broad as long, with margin weakly convex. Lower face 0.78–0.82 times as broad as long, centrally sparsely punctate. Head in dorsal view with genae rounded behind eyes; posterior ocellus contiguous with eye; FI = 70–75%; occipital carina mediodorsally weak or interrupted, ventrally abruptly curved to approach but not join the hypostomal carina about 1.0 times the basal mandibular width away from mandible. Antenna long and quite stout, with 66–68 flagellar segments; 20th segment 1.7–1.9 times as long as broad.

Mesoscutum polished, with sparse shallow punctures, in profile evenly but steeply rounded; notauli vestigial. Mesopleuron polished, the upper part punctate, the lower part closely punctate, rarely punctostriate; epicnemial carina curved towards but not reaching anterior margin of pleuron. Scutellum in profile weakly convex, laterally carinate for most of its length; scutellum in dorsal view 1.5–1.6 times as long as anteriorly broad, obsoletely punctate, sometimes a little wrinkled posteriorly. Metapleuron characteristically convex posterodorsally and flattened anteroventrally, closely punctate (Fig. 165); submetapleural carina evenly anteriorly broadened; posterior transverse carina of mesosternum strong laterally, medially produced slightly into a rounded lobe, often weak or obsolescent either side of this lobe. Propodeum in profile abruptly declivous; anterior transverse carina complete or interrupted lateromedially, posterior transverse carina absent; anterior area deeply impressed, striate; spiracular area short, almost smooth; posterior area irregularly rugose to reticulate; lateral longitudinal carina present anteriorly, not joined to spiracular margin by a short carina.

Fore wing length 21–23 mm; discosubmarginal cell as in Fig. 244; AI = 0.54–0.98; CI = 0.44–0.52; ICI = 0.64–0.83; SDI = 1.23–1.40; *cu-a* proximal to base of *Rs&M* by 0.1–0.3 times its own length; marginal cell proximally with a narrow glabrous band; 1st subdiscal cell anteriorly and distally broadly hirsute. Hind wing with 9–11 hamuli on *R*1; 1st abscissa of *Rs* almost straight, 2nd abscissa weakly bowed.

Fore leg with tibia barely flattened, with scattered stout spines on outer surface. Mid leg with longer tibial spur 1.2–1.5 times length of the shorter. Hind leg with coxa in profile 1.7–1.8 times as long as deep; trochantellus dorsally <0.1 times as long as broad; 4th segment of tarsus 2.2–2.3 times as long as broad; 4th segment of tarsus 2.2–2.3 times as long as broad; claws of female stout, abruptly curved, with long close pectinae, those of male similar but with pectinae shorter.

Gaster slender; tergite 2 in profile 5.0–5.7 times as long as posteriorly deep, laterotergite folded under, thyridia elliptical and separated from anterior margin of tergite by about 3–4 times its own length. Ovipositor apically very slender, its sheath narrow. Male with sternites 7–9 bearing fine scattered erect hairs; gonosquama long, distally subtruncate.

Colour generally yellowish brown, generally with mesoscutum bearing dark brownish vittae and with gastral tergites and sternites irregularly infuscate; interocellar area yellow; antenna golden; pterostigma yellowish brown; wings hyaline.

Variation. In most individuals the mesopleuron is regularly punctate, with the punctures closer ventrally. The female from Mexico has the lower part of the mesopleuron distinctly punctostriate.

Remarks. This species is named in honour of Dr Alvaro Umaña, who has done so much to organize the governmental care of the conservation cause in Costa Rica.

Enicospilus umanai closely resembles *E. americanus* and several other large species. However, unlike many others in the *E. americanus* complex none of the specimens of this species has any distinct trace of concentric striae or rugae present on the propodeum. Concentric striae or rugae are almost always present in *E. americanus*. A further characteristic feature of *E. umanai* is the distribution of hairs on the fore wing. In *E. umanai* the extreme anterior corner of the discosubmarginal cell is uniformly hirsute, whilst in *E. americanus* a small glabrous area is usually present. The convexity of the metapleuron differs in the two species; that of *E. americanus* is far more uniform, whilst in *E. umanai* the greatest convexity is along the posterodorsal margin, and anteroventrally the metapleuron is flattened. *E. umanai* is unusual in often having the distal corner of the discosubmarginal cell very acute (50–55°); in most species this corner is greater than 60°.

Biological Information. *Enicospilus umanai* is a Mesoamerican species whose range extends from Durango, Mexico, south to Costa Rica. In Costa Rica it is only known to occur in lower montane wet forest at altitudes between 1000 and 1400 m. At Monteverde it has only been collected between November and February even though most collecting at this locality has been undertaken between April and June. The pooled monthly catch is:

J	F	M	A	M	J	J	A	S	O	N	D
1	3	–	–	–	–	–	–	–	–	2	4

Nothing is known of its biology.

Material Examined

Holotype ♀, **Costa Rica**: Puntarenas Prov., Monteverde, 1300 m, xi.1985 *(Haber)* (BMNH).

Paratypes. **Costa Rica**: Puntarenas Prov.: 2 ♂, 5 ♀, Monteverde, 1350 m, xi, xii.1961, i, ii.1962 (*Palmer*) (TC); 1 ♀, same locality, xii.1979 (*Janzen*) (BMNH); 1 ♀, same locality, xii.1985 (*Haber*) (BMNH). **Mexico**: Chiapas: 1 ♂, San Cristobal, viii.1969 (*Kritsch*) (CNC): Durango: 1 ♀, Tepalcates, 50 km W. Durango, vii.1964 (*Howden*) (CNC).

Enicospilus quintanai sp. n.

(Fig. 245)

Description. Mandibles moderately long, quite stout being proximally weakly tapered and distally more or less parallel-sided, apically twisted about 30°; upper mandibular tooth slightly compressed, 1.3–1.5 times as long as the lower tooth; outer mandibular surface more or less flat with scattered pubescence. Labrum 0.3 times as long as broad; malar space 0.3–0.4 times as long as basal mandibular width. Clypeus in profile flat, margin acute; clypeus in front view 1.4–1.5 times as broad as long, the margin truncate to weakly convex. Lower face 0.64–0.71 times as broad as long, finely granulate. Head in dorsal view with genae rounded behind eyes; posterior ocellus contiguous with eye; FI = 68–73%; occipital carina mediodorsally weak or narrowly interrupted, ventrally curved to almost join hypostomal carina about 0.8 times the basal mandibular width away from mandible. Antenna long and slender, with 66–68 flagellar segments; 20th segment 1.9–2.0 times as long as broad.

Mesoscutum weakly polished, finely granulate, in profile abruptly rounded; notauli vestigial. Mesopleuron weakly polished, the upper part obsoletely puncto-granulate, the lower part punctostriate; epicnemial carina inclined towards, but not reaching the anterior margin of pleuron. Scutellum in profile weakly convex, laterally carinate for 0.9 of its length; scutellum in dorsal view 1.4 times as long as anteriorly broad, granulate. Metapleuron weakly convex, granulate; submetapleural carina evenly anteriorly broadened; posterior transverse carina of mesosternum obsolescent on midline. Propodeum in profile abruptly declivous; anterior transverse carina sinuous, complete, posterior one vestigial; anterior area short and deeply impressed, with isolated striae; spiracular area short, smooth; posterior area coarsely rugose, with the rugae tending to be concentric posteriorly; lateral longitudinal carina from complete to present only anteriorly, not joined to spiracular margin by a distinct short carina.

Fore wing length 16–18 mm; discosubmarginal cell as in Fig. 245; AI = 0.68–0.95; CI = 0.52–1.10; ICI = 1.09–1.75; SDI = 1.47–1.59; *cu-a* proximal to the base of *Rs&M* by about 0.1–0.2 of its own length; marginal cell proximally slightly more sparsely pubescent adjacent to *Rs+2r*; 1st subdiscal cell with anterior 0.3–0.4 sparsely hirsute. Hind wing with 9–10 hamuli on *R*1; 1st abscissa of *Rs* straight, 2nd abscissa straight.

Fore leg with tibia weakly flattened, with scattered stout spines on outer surface. Mid leg with longer tibial spur 1.3–1.4 times length of the shorter. Hind leg with coxa in profile 1.6–1.7 times as long as deep; trochantellus dorsally obscured; 4th segment of tarsus 2.5–2.6 times as long as broad; claws of male abruptly rounded, with short, close pectination.

Gaster moderately slender, though a little stouter than many related species; tergite 2 in profile 3.3–3.7 times as long as posteriorly deep, laterotergite folded under, thyridia oval and separated from anterior margin of tergite by about 1.5 times its own length. Female unknown. Male with sternites 7–9 bearing close long stout erect hairs; gonosquama apically quite acutely pointed.

Colour generally yellowish orange; interocellar area yellowish; antenna slightly infuscate apically; pterostigma orange; wings more or less hyaline.

Variation. None remarkable.

REMARKS. *Enicospilus quintanai* can most easily be distinguished from others in the *E. americanus* complex by the large ICI, its rather matt appearance, the densely hirsute male sternites and its slightly stouter gaster. Structurally it is quite similar to *E. ugaldei* from which it differs in being less polished and not punctate, generally having a narrower face and shorter fenestra, and in having the larger ICI. The metapleuron of *E. ugaldei* is more evenly convex than that of *E. quintanai*.

BIOLOGICAL INFORMATION. Only three isolated specimens of *Enicospilus quintanai* are known. All were collected in lowland wet forest. Nothing is known about its biology.

MATERIAL EXAMINED

Holotype ♂, **Mexico**: Quintana Roo, X-can, vi.1962 (*Welling*) (CNC).

Paratypes. **Panama**: 1 ♂, Barro Colorado Island, xi.1978 (*Wolda*) (RNH); 1 ♂, same locality, iv.1979 (*Wolda*) (TC).

Enicospilus americanus (Christ)

(Figs 98, 246)

[*Ichneumon macrurus* Linnaeus; Drury, 1773: 1. Misidentification.]
Ichneumon luteus americanus Christ, 1791: 358. Holotype ♀, U.S.A.: New York (lost).
[*Ophion macrurum* (L.) Westwood *in* Drury, 1837: 92. Misidentification.]
Ophion rugosus Brullé, 1846: 138. Holotype ♀, 'North America' (MNHN). [Synonymized by Hooker, 1912: 148.]
[*Ophion cecropiae* Scudder, 1863: 188. Nomen nudum.]
Ophion cecropiae Sanborn, 1863: 169. Holotype ? sex, U.S.A.: Mass. (lost).
[*Ophion undulatus* Gravenhorst; Taschenberg, 1875: 430. Misidentification.]
Eremotylus Druryi Kriechbaumer, 1901*c*: 152. Syntypes 3 ♀, 1 ♂, U.S.A.: New York (ZSBS). [Synonymized by Hooker, 1912: 149.]
[*Eremotylus macrurus* (L.) Felt, 1904: 101. Misidentification.]
[*Allocamptus macrurus* (L.) Morley, 1912: 24. Misidentification.]
[*Enicospilus macrurus* (L.) Essig, 1926: 792. Misidentification.]
Enicospilus americanus (Christ) Townes, 1945: 737.

DESCRIPTION. Mandibles of moderate length, proximally strongly narrowed, distally almost parallel-sided, apically twisted 15–30°; upper mandibular tooth subcylindrical, 1.2–1.5 times as long as the lower tooth; outer mandibular surface finely and sparsely hirsute centrally, more densely hirsute on proximoventral lobe; outer surface flat centrally, with a broad shallow proximal concavity. Labrum 0.2–0.4 times as long as broad; malar space 0.2–0.3 times as long as basal mandibular width. Clypeus in profile usually distinctly out-flared, margin relatively blunt; clypeus in front view 1.4–1.6 times as broad as long, the margin truncate. Lower face 0.75–0.90 times as broad as long, centrally with scattered fine punctures, the area between the punctures often finely microreticulate. Head in dorsal view with genae barely narrowed behind eyes, in larger individuals distinctly buccate; posterior ocellus contiguous with eye; FI = 70–80%; occipital carina mediodorsally from complete and slightly dipped, to narrowly incomplete, ventrally curved to approach but not actually join hypostomal carina about 1.0 times the basal mandibular width away from mandible. Antenna long but relatively stout, with 63–77 flagellar segments; 20th segment 1.4–1.7 times as long as broad.

Mesoscutum polished, with close shallow punctures, in profile evenly rounded; notauli very shallow. Mesopleuron weakly polished, the upper part punctate to punctostriate, the lower part punctostriate; epicnemial carina curved towards anterior margin of pleuron. Scutellum in profile moderately convex, laterally carinate for 0.8 or more of its length; scutellum in dorsal view 1.3–1.5 times as long as anteriorly broad, anteriorly generally punctate grading to striate posteriorly. Metapleuron moderately convex, rather variable, from regularly punctate to puncto-reticulate, irregularly rugose or even somewhat striate; submetapleural carina evenly anteriorly broadened; posterior transverse carina of mesosternum complete. Propodeum in profile rather abruptly declivous, posterodorsally deplanate; anterior transverse carina complete or effaced lateromedially, posterior transverse carina generally discernible as a lateral crest; anterior area deeply impressed, striate, spiracular area very short, smooth or punctate, posterior area coarsely rugose, often with rugae concentric posterodorsally; lateral longitudinal carina present only anteriorly, not joined to spiracular margin by a short carina.

Fore wing length 18–26 mm; discosubmarginal cell as in Fig. 246; AI = 0.83–1.55; CI = 0.41–0.69; ICI = 0.50–0.80; SDI = 1.20–1.35; *cu-a* from subopposite the base of *Rs&M*, to proximal to it by about 0.3 times its own length; marginal cell proximally more or less uniformly hirsute; 1st subdiscal cell broadly hirsute. Hind wing with 10–12 hamuli on *R*1; 1st abscissa of *Rs* almost straight, 2nd abscissa weakly bowed.

Fore leg with tibia very weakly flattened, with scattered spines on outer surface. Mid leg with longer tibial spur 1.2–1.4 times length of the shorter. Hind leg with coxa in profile 1.7–1.8 times as long as deep; trochantellus dorsally <0.1 times as long as broad; 4th segment of tarsus 2.4–2.9 times as long as broad; claws of female strongly curved with long strong, close pectinae (Fig. 98), those of male similar but with pectinae shorter.

Gaster moderately slender; tergite 2 in profile 3.7–5.8 times as long as posteriorly deep, laterotergite turned under, thyridia obovate and separated from anterior margin of tergite by about 2–3 times its own length. Ovipositor slender, its sheath narrow. Male with sternites 7–9 bearing fine erect pubescence; gonosquama long, distally rounded.

Colour generally brownish orange with the head paler yellowish; interocellar area yellow; antenna orange; pterostigma brownish or yellowish orange; wings from very weakly to quite strongly yellowish.

VARIATION. There is a considerable range of morphological variation within this species, and it is possible that more than one sibling species may be confused here. Typical examples of *E. americanus* are large insects (fore wing length 23+ mm) with slightly yellow wings, the clypeus out-flared and the male only has scattered fine erect hairs on the posterior gastral sternites. In the southern part of the U.S.A. and northern Mexico, the specimens have almost hyaline wings. A number of smaller individuals have the clypeus almost flat, but these are otherwise morphologically more or less indistinguishable from typical *E. americanus* and have the same host range. I conclude that these are simply small individuals of the species. The sculpture of the metapleuron is so variable as to be of no value in characterizing the species

The major taxonomic problem concerns a group of male specimens (fore wing length 19–23 mm) that have long stout dense pubescence on the posterior sternites. In all other species I have seen, I have never encountered variation of this extent in this character, and this suggests that this group of specimens represents a different species. I have seen a series of it from Aurora, Colorado, U.S.A. (Peigler, 1985) reared from *Automeris io*, a hemileucine saturniid (all host records for typical *E. americanus* are from saturniine saturniids) further suggesting that it may be a separate species. However, I have not been able to find characters which would reliably allow me to separate the females (reared from *Automeris*) from females of typical *E. americanus*. I (Gauld, 1988) opted to treat the 'hairy males' as an unnamed variety of *E. americanus*, pending further study.

REMARKS. Until the publication of Townes' (1945) catalogue, this species was generally known as *Eremotylus* or *Ophion macrurus*. The true *macrurus* of Linnaeus is a species of *Megarhyssa* (Townes & Townes, 1960; Fitton, 1978). *E. mexicanus* (Cresson) has been treated as a synonym of *E. americanus* since 1912, but examination of the holotype has shown that *E. mexicanus* is a distinct species (see p. 142)

Enicospilus americanus has been confused with other species of the genus both in the United States and in Latin America. In the north it has not clearly been separated from either *E. texanus* or *E. glabratus*. It differs from the former species in being larger, having more strongly curved claws, a generally narrower face and narrower malar space, and longer antennae. The curvature of *Rs+2r* in the fore wing differs between the two species (see Figs 236, 237, 246). *E. americanus* differs from *E. glabratus* in the form of the alar fenestra and in not having a distinctive cluster of hairs proximal to this fenestra (see Figs 224, 246). The clypeus of *E. glabratus* is never out-flared and *E. americanus* has the lower end of the genal carina obsolescent, not joining the hypostomal carina as does that of *E. glabratus*. In tropical America *E. americanus* has been confused with a group of other species that include *E. mexicanus*, *E. tenuigena*, *E. lebophagus*, *E. brevis* and other taxa without alar sclerites. The present key should allow these taxa to be differentiated.

BIOLOGICAL INFORMATION. *Enicospilus americanus* is a common species throughout much of eastern North America. It range extends into southern Canada and west to California. It occurs as far south as Argentina (Townes & Townes, 1966), and I have seen specimens from Tucumán and southern Brazil. Almost certainly the references to *Enicospilus undulatus* (a European species) as Neotropical (Taschenberg, 1875; Brèthes, 1909; Schrottky, 1913) are based on misidentifications of *E. americanus*. *E. americanus* is, however, extremely rare in tropical America and is generally replaced by a complex of very similar species that include *E. lebophagus*, *E. mexicanus*, *E. cameronii* and *E. tenuigena*.

There are numerous early records of *E. americanus* attacking many hosts, but as it was commonly confused, not only with other species of Ophioninae, but also with *Netelia* species, all the early records are best disregarded unless authenticated material can be examined. The rearings I have seen suggest that *E. americanus* is a polyphagous parasitoid of large saturniids that construct thick-walled cocoons. This includes most species of Saturniinae in North America. I have seen authenticated specimens reared in the United States from *Antheraea polyphemus* (Cramer), *Callosamia promethea* (Drury), *Callosamia securifera* (Maassen), *Hyalophora cecropia* (L.), *Hyalophora euryalis* (Boisduval), *Rothschildia orizaba* (Westwood) and *Samia cynthia* (Drury). It is recorded additionally from *Actias luna* (L.) (Carlson, 1971), and in South America in is purported to parasitize *Rothschildia maurus* (Burmeister) (Blanchard, 1940), *R. arethusa* (Walker) (Costa Lima, 1962). Bourquin (1947) recorded it from the lasiocampid *Tolype pauperata* (Burmeister), but this host record is highly suspect.

I have seen a series of the 'hairy male morph' of *E. americanus* reared from *Automeris io* (F.). Although this moth is a hemileucine, not a saturniine, it spins a more sturdy cocoon than do most other hemileucines (Ferguson, 1971).

Peigler (1977) observed that the adults of *E. americanus* appear about the same time as the adults of their saturniid host. Oviposition is into a very young larva (Price, 1975) and the ophionine kills its host after the latter has formed a cocoon. Some individuals enter diapause as a prepupa and do not emerge for two years. For example, in CAS is a female that emerged in September 1925 from a cocoon of *Antheraea polyphemus* collected in late 1923. Peigler (1985) suggested that populations of *E. americanus* may move, following fluctuations in populations of *Callosamia promethea* and *C. securifera*.

MATERIAL EXAMINED

76 ♂, 89 ♀, from the following: **Argentina** (Tucumán); **Bolivia** (Cochabamba); **Brazil** (Nova Teutonia); **Canada** (Ontario, Quebec); **Mexico** (Chiapas, Chihuahua, Durango, Mexico State, Nuevo León, Tlaxcala, Veracruz); **U.S.A.** (California, Colorado, Delaware, Florida, Georgia, Maryland, Massachusetts, Michigan, Minnesota, New Hampshire, New Jersey, New York, North Carolina, Ohio, South Carolina, Texas, Virginia) (BMNH, CAS, CNC, FSCA, PANS, TC, USNM).

Enicospilus tenuigena (Kriechbaumer)

(Figs 166, 167, 168, 247)

Eremotylus tenuigena Kriechbaumer, 1901*c*: 153. Holotype ♀, BRAZIL (TMP) [examined].
Enicospilus tenuigena (Kriechbaumer) Townes & Townes, 1966: 183.

DESCRIPTION. Mandibles moderately stout, fairly evenly narrowed, apically twisted 10–20° (Fig. 168); upper mandibular tooth compressed, sometimes a little upcurved, 1.5–1.7 times as long as the lower tooth; outer mandibular surface centrally flattish, proximally with a broad shallow concavity which bears close fine pubescence. Labrum 0.1–0.2 times as long as broad; malar space 0.2–0.3 times as long as basal mandibular width. Clypeus in profile flat, margin blunt; clypeus in front view 1.3–1.4 times as broad as long, margin truncate4 apically. Lower face 0.66–0.74 times as broad as long, centrally punctate to punctostriate. Head in dorsal view with genae rounded behind eye; posterior ocellus very close to eye; FI = 75–80%; occipital carina mediodorsally complete, ventrally curved to approach but not join hypostomal carina about 0.9 times the basal mandibular width away from mandible. Antenna long and slender, with 58–66 flagellar segments; 20th segment 1.8–2.0 times as long as broad.

Mesoscutum finely punctate, in profile evenly rounded; notauli distinct but shallow and short. Mesopleuron polished, the upper part with obsolescent sculpture, the lower part striate; epicnemial carina with upper end curved towards anterior margin of pleuron, but then effaced. Scutellum in profile moderately to weakly convex, laterally carinate for 0.8 or more of its length; scutellum in dorsal view 1.3–1.5 times as long as anteriorly broad, smooth with some wrinkling posteriorly. Metapleuron moderately convex, striate (Fig. 166); submetapleural carina weakly broadened anteriorly; posterior transverse carina of mesosternum strong, complete, with a central projecting V-shaped part. Propodeum in profile evenly but steeply rounded; anterior transverse carina complete, posterior transverse carina indistinct; anterior area short, deeply impressed, striate; spiracular area short, more or less smooth, posterior area dorsally deplanate, concentrically striate; lateral longitudinal carina present anteriorly, not joined to spiracular margin by a short carina.

Fore wing length 16–25 mm; discosubmarginal cell as in Fig. 247; AI = 0.95–1.06; CI = 0.45–0.67; ICI = 0.77–0.93; SDI = 1.33–1.69; *cu-a* proximal to the base of *Rs&M* by 0.1–0.3 times its own length; marginal cell proximally more or less evenly hirsute except for extreme proximal corner which is virtually glabrous; 1st subdiscal cell anteriorly sparsely hirsute. Hind wing with 5–10 hamuli on *R*1; 1st abscissa of *Rs* more or less straight, 2nd abscissa weakly bowed.

Fore leg with tibia slightly flattened, with scattered stout spines on outer surface. Mid leg with longer tibial spur 1.4–1.6 times length of the shorter. Hind leg with coxa in profile 1.7–1.8 times as long as deep; trochantellus dorsally <0.1 times as long as broad; 4th segment of tarsus 2.3–3.6 times as long as broad; claws of female long, strongly curved, with close, moderately long pectinae, those of male similar but slightly shorter and more strongly curved.

Gaster slender; tergite 2 in profile 4.6–5.4 times as long as posteriorly deep, laterotergite folded under, thyridia elliptical to obovate and separated from anterior margin of tergite by about 3–4 times its own length. Ovipositor slender, its sheath narrow. Male with sternites 7–9 bearing fine decumbent pubescence, the last sternite very unusual in being far longer than the penultimate one (Fig. 167); gonosquama proximally narrowed, distally parallel-sided, apically truncate.

Colour generally pale brownish yellow, with a median or a median and pair of lateral vittae on mesoscutum dark brown; gaster with tergites 3+ infuscate; interocellar area yellow; antenna yellowish brown, distally infuscate, centrally golden; pterostigma golden; wings hyaline.

VARIATION. *Enicospilus tenuigena* is morphologically a rather uniform species that shows some variation in the colour of the mesoscutum as outlined above. Most specimens have the submetapleural carina only weakly broadened anteriorly, but in isolated larger specimens it can be more abruptly widened.

REMARKS. The male of this species is very easily recognizable on account of the long subgenital plate and the characteristic gonosquamae. The female resembles the male in colour pattern, and the combination of this, the striate metapleuron and the rather marked ventral protuberance near the base of *Rs+2r* in the fore wing should enable the female to be recognized. However, it is sometimes difficult to separate from females of some other species in the *E. americanus* complex.

BIOLOGICAL INFORMATION. *Enicospilus tenuigena* is a widely distributed species whose range extends from central Costa Rica southwards to Ecuador and Brazil. In Central America it is only known from wet forest areas from sea-level up to about 700 m. The scattered collecting dates suggest it may occur as an adult throughout the year.

MATERIAL EXAMINED

Holotype ♀, **Brazil**: Santos (TMP).

Colombia: 1 ♀, Valle, Lago Calima, in tropical wet forest (FSCA). **Costa Rica**: Alajuela Prov.: 1 ♀, Finca San Gabriel, 3 km W. Dos Ríos, 850 m, vi.1986 (*Gauld*) (BMNH): Cartago Prov.: 1 ♀, Turrialba, 700 m, vii.1965 (*Real*) (CAS): Limón Prov.: 1 ♂, Cerro Tortuguero, N. edge of Tortuguero National Park, 0–100 m, v.1984 (*Janzen & Hallwachs*) (BMNH): San José Prov.: 3 ♂, 1 ♀, Estacion Carrillo, Braulio Carrillo National Park, 700 m, i, ii, v.1985 (*Chacon*) (BMNH). **Ecuador**: 1 ♀, Pichincha, nr Nanegal, 1200 m, ix.1977 (*Peña*) (BMNH). **Panama**: 1 ♀, Barro Colorado Island, iv.1978 (*Wolda*) (RNH); 1 ♂, same locality, ii.1983 (*Wolda*) (TC); 1 ♂, 2 ♀, same locality, 120 m, xii.1983, vii.1984, ix.1985 (*Wolda*) (BMNH)

Enicospilus venezuelanus (Szépligeti)

Allocamptus venezuelanus Szépligeti, 1906: 149. Lectotype ♂, VENEZUELA (TM), designated by Townes & Townes (1966: 184) [examined].

Enicospilus venezuelanus (Szépligeti) Townes & Townes, 1966: 184.

DESCRIPTION. Mandibles of moderate length, proximally evenly narrowed, distally almost parallel-sided, apically twisted 10–20°; upper mandibular tooth slightly compressed, 1.4 times as long as the lower tooth; outer mandibular surface rather flat, with fine inconspicuous pubescence, and with a shallow and indistinct proximal concavity. Labrum 0.2 times as long as broad; malar space 0.3 times as long as basal mandibular width. Clypeus in profile slightly out-flared, margin centrally blunt; clypeus in front view 1.4 times as broad as long, with margin apically truncate. Lower face 0.76 times as broad as long, centrally finely and sparsely punctate. Head in dorsal view with genae constricted behind the eyes; posterior ocellus contiguous with the eye; FI = 75%; occipital carina mediodorsally narrowly interrupted, ventrally strong, curved to join hypostomal carina about 0.7 times the basal mandibular width away from mandible. Antenna long and slender, with 68 flagellar segments; 20th segment 2.0 times as long as broad.

Mesoscutum weakly polished and finely puncto-granulate, in profile abruptly rounded; notauli vestigial. Mesopleuron weakly polished, the upper part punctate, the lower part more closely punctate with the punctures tending to coalesce, becoming punctostriate; epicnemial carina abruptly curved towards anterior margin of pleuron. Scutellum in profile moderately convex, laterally carinate for 0.9 of its length; scutellum in dorsal view 1.6 times as long as anteriorly broad, punctate. Metapleuron evenly convex, coarsely punctate; submetapleural carina evenly anteriorly broadened; posterior transverse carina of mesosternum complete. Propodeum in profile evenly declivous; anterior transverse carina quite weak with lateromedian and lateral parts hardly represented, posterior one absent; anterior area short, striate; spiracular area granulate; posterior area coarsely transversely concentrically rugose-striate; lateral longitudinal carina present anteriorly, not joined to spiracular margin by a short carina.

Fore wing length 24 mm; discosubmarginal cell similar to that shown in Fig. 247; AI = 0.96; CI = 0.46; ICI = 0.62; SDI = 1.31; *cu-a* proximal to the base of *Rs&M* by about 0.3 times its own length; marginal cell proximally narrowly glabrous adjacent to *Rs+2r*; 1st subdiscal cell with anterior and distal parts broadly hirsute. Hind wing with 10 hamuli on *R*1; 1st abscissa of *Rs* straight, 2nd abscissa straight.

Fore leg with tibia slightly flattened, with isolated fine spines on outer surface. Mid leg with longer tibial spur 1.4 times length of the shorter. Hind leg with coxa in profile 1.9 times as long as deep; trochantellus dorsally <0.1 times as long as broad; 4th segment of tarsus 2.5 times as long as broad; claws of male of moderate length, abruptly rounded with a long stout apical point.

Gaster long and slender; tergite 2 in profile 5.9 times as long as posteriorly deep, laterotergite folded under, thyridia elliptical and separated from anterior margin of tergite by about 3 times its own length. Female unknown. Male with sternites 7–9 bearing long stout close erect pubescence; gonosquama long, distally rounded.

Colour generally pale yellowish brown with segments 3–5 of gaster darker (or possibly discoloured due to age); interocellar area yellowish; antenna orange; pterostigma yellowish; wings more or less hyaline.

REMARKS. *Enicospilus venezuelanus* is not known to occur in the study region delimited, but as it occurs in Venezuela and is structurally very similar to many Central American species, it has been included here for the sake of comparison. This species belongs to the *E. americanus* species-complex, and most closely resembles *E. peigleri*. Both have similar shaped mandibles, similarly sculptured alitrunks and rather similar venation. However, *E. venezuelanus* is much larger, has the genal and hypostomal carinae meeting, and quite a different arrangement of pubescence on the sternites.

BIOLOGICAL INFORMATION. Despite the fact that I have examined a considerable number of South American specimens of the *E. americanus* species-complex, I have seen only a single example of *E. venezuelanus*, the lectotype from Venezuela. Nothing is known about its biology.

MATERIAL EXAMINED

Lectotype ♂, **Venezuela**: Merida (TM).

Enicospilus peigleri Gauld

(Fig. 248)

Enicospilus peigleri Gauld, 1988: 46. Holotype ♀ U.S.A.: Florida (FSCA) [examined].

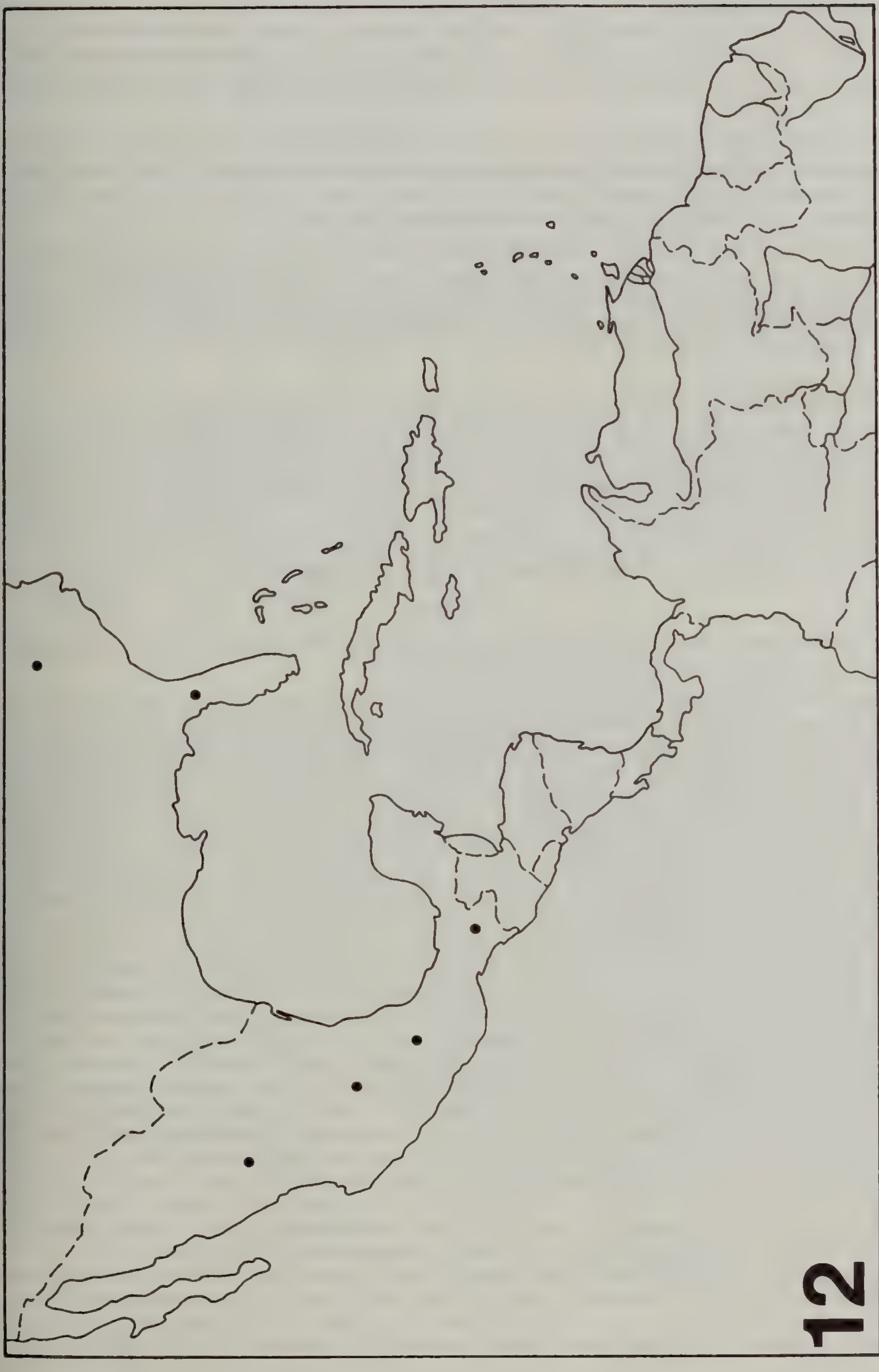
DESCRIPTION. Mandibles long and stout, proximally abruptly narrowed, distally parallel-sided, apically twisted 10–20°; upper mandibular tooth subcylindrical or slightly compressed, 1.4–1.6 times as long as the lower tooth; outer mandibular surface finely hirsute, centrally rather flat and with a weak proximal concavity. Labrum 0.3 times as long as broad; malar space 0.2–0.3 times as long as basal mandibular width. Clypeus in profile almost flat, margin blunt; clypeus in front view 1.4–1.5 times as broad as long, with margin apically weakly convex. Lower face 0.71–0.80 times as broad as long, centrally finely punctate. Head in dorsal view with genae very slightly inflated; posterior ocellus very close to eye; FI = 60–65%; occipital carina mediodorsally complete, or weak or interrupted, ventrally evanescent, not curved to join hypostomal carina. Antenna very long and slender, with 62–65 flagellar segments; 20th segment 1.9–2.2 times as long as broad.

Mesoscutum polished, obsoletely punctate, in profile evenly rounded; notauli vestigial. Mesopleuron polished, the upper part punctate, ventrally grading to punctostriate; epicnemial carina with upper end curved to approach anterior margin of pleuron, its lower corner produced backwards, acute. Scutellum in profile weakly convex, laterally strongly carinate for all of its length; scutellum in dorsal view 1.4–1.5 times as long as anteriorly broad, rather smooth. Metapleuron polished, convex, punctate to punctostriate; submetapleural carina evenly anteriorly broadened; posterior transverse carina of mesosternum complete. Propodeum in profile abruptly declivous; anterior transverse carina complete, posterior transverse carina absent; anterior area short, with scattered striae; spiracular area very short, more or less smooth; posterior area dorsally deplanate, concentrically rugose-striate; lateral longitudinal carina present at least anteriorly, not joined to spiracular margin by a short carina.

Fore wing length 15–18 mm; discosubmarginal cell as in Fig. 248; AI = 0.76–1.28; CI = 0.34–0.62; ICI = 0.59–0.72; SDI = 1.20–1.28; *cu-a* subopposite to the base of *Rs&M*; marginal cell proximally evenly hirsute except for a small glabrous area in extreme proximal corner; 1st subdiscal cell hirsute anteriorly and posterodistally. Hind wing with 6–8 hamuli on *R*1; 1st abscissa of *Rs* almost straight, 2nd abscissa bowed.

Fore leg with tibia slightly flattened, with numerous slender spines on outer surface. Mid leg with longer tibial spur 1.2–1.3 times length of the shorter. Hind leg with coxa in profile 1.7–1.8 times as long as deep; trochantellus dorsally <0.1 times as long as broad; 4th segment of tarsus 2.4–2.6 times as long as broad; claws of female very long and slender, apically abruptly turned, but apical tooth short and the pectinae short and scattered; claws of male similar but with pectinae finer and closer.

Gaster slender; tergite 2 in profile 4.2–5.3 times as long as posteriorly deep, laterotergite turned under, thyridia elliptical and separated from anterior margin of tergite by about 2–3 times its own length.



12

Map 12 Localities at which *Enicospilus peigleri* has been collected.

Ovipositor slender, its sheath narrow. Male with sternites 7–9 bearing fine scattered semierect hairs; gonosquama rounded apically.

Colour generally yellowish brown, head and scutellum more yellow, extreme posterior end of gaster slightly infuscate; interocellar area yellow; antenna orange; pterostigma brownish yellow; wings hyaline.

VARIATION. Some of the Mexican specimens have the propodeal sculpture weaker and finer than the majority of individuals.

REMARKS. *Enicospilus peigleri* is likely to have been confused with *E. americanus* which it resembles in general appearance. It differs in having more slender antennae, unusually robust mandibles and, in most cases, in having a small protuberance basally on the posterior margin of *Rs+2r*. The long slender claws of this species are quite unlike those of any other sympatric *Enicospilus*.

BIOLOGICAL INFORMATION. *Enicospilus peigleri* is a fairly widespread species whose range extends from about 35°N in eastern North America, south to about 17°N in southern Mexico (Map 12). It has not been reared, but several of the specimens have the mandibular teeth almost completely worn away, suggesting this insect emerges from a cocoon in hard earth. Many of the specimens examined were collected in the hottest, driest part of the summer.

MATERIAL EXAMINED

Holotype ♀, **U.S.A.**: Florida: Alachua Co., Gainesville, viii.1970 (*Mead*) (FSCA)

Paratypes. **Mexico**: Chiapas: 1 ♂, San Cristobal de las Casas, vii.1969 (*Kritsch*) (CNC): Durango: 1 ♀, 11 km W. Durango, 2200 m, viii.1964 (*Mason*) (CNC): Mexico Ste: 1 ♂, Ixtapan la Sal, 2200 m, viii.1962 (*Evans*) (MCZ): San Luis Potosí: 1 ♀, El Salto Falls, vi.1963 (*Woodruff*) (FSCA). **U.S.A.**: Florida: 2 ♀, Gainesville, xi.1971, x.1972 (*Mead*) (FSCA): South Carolina: 1 ♀, Greenville, viii.1982 (*Peigler*) (BMNH).

Enicospilus neotropicus Hooker

(Fig. 249)

Enicospilus neotropicus Hooker, 1912: 69. Lectotype ♀, DOMINICAN REPUBLIC (USNM), designated by Townes & Townes (1966: 182) [examined].

DESCRIPTION. Mandibles long, proximally narrowed, distally parallel-sided, apically twisted 10–20°; upper mandibular tooth cylindrical, about 2.0 times as long as the lower tooth; outer mandibular surface with an impressed hirsute groove running from near upper proximal corner to base of teeth; proximal concavity strong. Labrum 0.4–0.5 times as long as broad; malar space 0.4–0.5 times as long as basal mandibular width. Clypeus in profile convex, margin impressed, acute; clypeus in front view 1.5–1.7 times as broad as long, margin weakly convex apically. Lower face 0.69–0.82 times as broad as long, centrally coarsely punctate. Head in dorsal view with genae rounded; posterior ocellus close to eye; FI = 57–65%; occipital carina mediodorsally complete, ventrally curved to join hypostomal carina about 1.0 times the basal mandibular width away from mandible. Antenna long and slender, with 63–66 flagellar segments; 20th segment 1.9–2.0 times as long as broad.

Mesoscutum polished, closely punctate, in profile evenly rounded; notauli short, but quite deeply impressed. Mesopleuron polished, the upper part punctate to punctostriate, the lower part more coarsely sculptured, punctogranulate to punctostriate; epicnemial carina inclined towards anterior margin of pleuron. Scutellum in profile weakly convex, laterally carinate for all of its length; scutellum in dorsal view 1.8–2.0 times as long as anteriorly broad, shallowly, closely punctate. Metapleuron weakly convex, coarsely and closely punctate to rugose; submetapleural carina evenly anteriorly broadened; posterior transverse carina of mesosternum complete. Propodeum in profile evenly rounded; anterior transverse carina complete, posterior transverse carina absent; anterior area quite long, irregularly rugose/striate; spiracular area quite long, punctate; posterior area reticulate/wrinkled; lateral longitudinal carina from present anteriorly to complete, usually not joined to spiracular margin by a short carina.

Fore wing length 13–14 mm; discosubmarginal cell as in Fig. 249; AI = 0.42–0.76; CI = 0.27–0.54; ICI =0.36–0.45; SDI = 1.18–1.23; *cu-a* from more or less opposite to, to proximal to base of *Rs&M*; marginal cell sparsely, but extensively hirsute; 1st subdiscal cell with anterior and distal parts hirsute. Hind wing with 7–8 hamuli on *R*1; 1st abscissa of *Rs* straight, 2nd abscissa almost straight.

Fore leg with tibia slightly flattened, with scattered spines on outer surface. Mid leg with longer tibial spur 1.5–1.6 times length of the shorter. Hind leg with coxa in profile 1.7–1.9 times as long as deep; trochantellus dorsally 0.1 times as long as broad; 4th segment of tarsus 2.9–3.1 times as long as broad; claws of female long, weakly curved and with quite close pectinae, those of male similar but with pectinae finer and very much more closer together.

Gaster long and slender; tergite 2 in profile 5 or more times as long as posteriorly deep, laterotergite upturned, thyridia elliptical and separated from anterior margin of tergite by about 3 times its own length. Ovipositor slender, its sheath narrow. Males with sternites 7–9 bearing fine semidecumbent pubescence; gonosquama obliquely truncate.

Colour generally orange-brown with most of head paler yellowish; interocellar area yellowish; antenna orange; pterostigma orange-brown; wings hyaline.

VARIATION. A male from the Dominican Republic has the head, scutellum and sides of the alitrunk whitish.

REMARKS. Hooker (1912) claimed to have specimens of this species from Chile, but I have been unable to locate these and I have seen no specimens from outside the general area of the Caribbean and Florida. However, I have seen several specimens of a similar, but undescribed species from Chile, which has much broader genae, and another, similar undescribed species occurs in Bolivia. The missing Hooker paralectotype(s) may be one of these species.

The possession of the mandibular groove and closely pectinate male claws indicate that *Enicospilus neotropicus* belongs to the *E. ramidulus* species-group. It differs from any other described New World species in this group in lacking a central sclerite, in having a larger fenestra and in having a more strongly sinuous *Rs+2r*.

BIOLOGICAL INFORMATION. *Enicospilus neotropicus* is only known to occur in the Caribbean and in southern Florida (Map 13). Its host is unknown.

MATERIAL EXAMINED

Lectotype ♀, **Dominican Republic**: San Francisco, ix.1905 (*Busck*) (USNM). Paralectotypes, 2 ♂, same data as lectotype (USNM).

Dominican Republic: 1 ♂, La Cumbre, Santiago, 1000 m, iv.1978 (*Woodruff*) (FSCA); 1 ♀, Los Hidalgros, vi.1969 (*Flint & Gómez*) (USNM). **Jamaica**: 1 ♂, Kingston, iii.1900 (*Taylor*) (USNM); 2 ♂, Liguanen Plain, xi-xii.1911 (*Brues*) (MCZ); 2 ♀, Mandeville, xi.1970 (*Frank*) (BMNH). **U.S.A.**: Florida: 1 ♂, S. Miami, ix (*Graenicher*) (MCZ).

Enicospilus doylei sp. n.

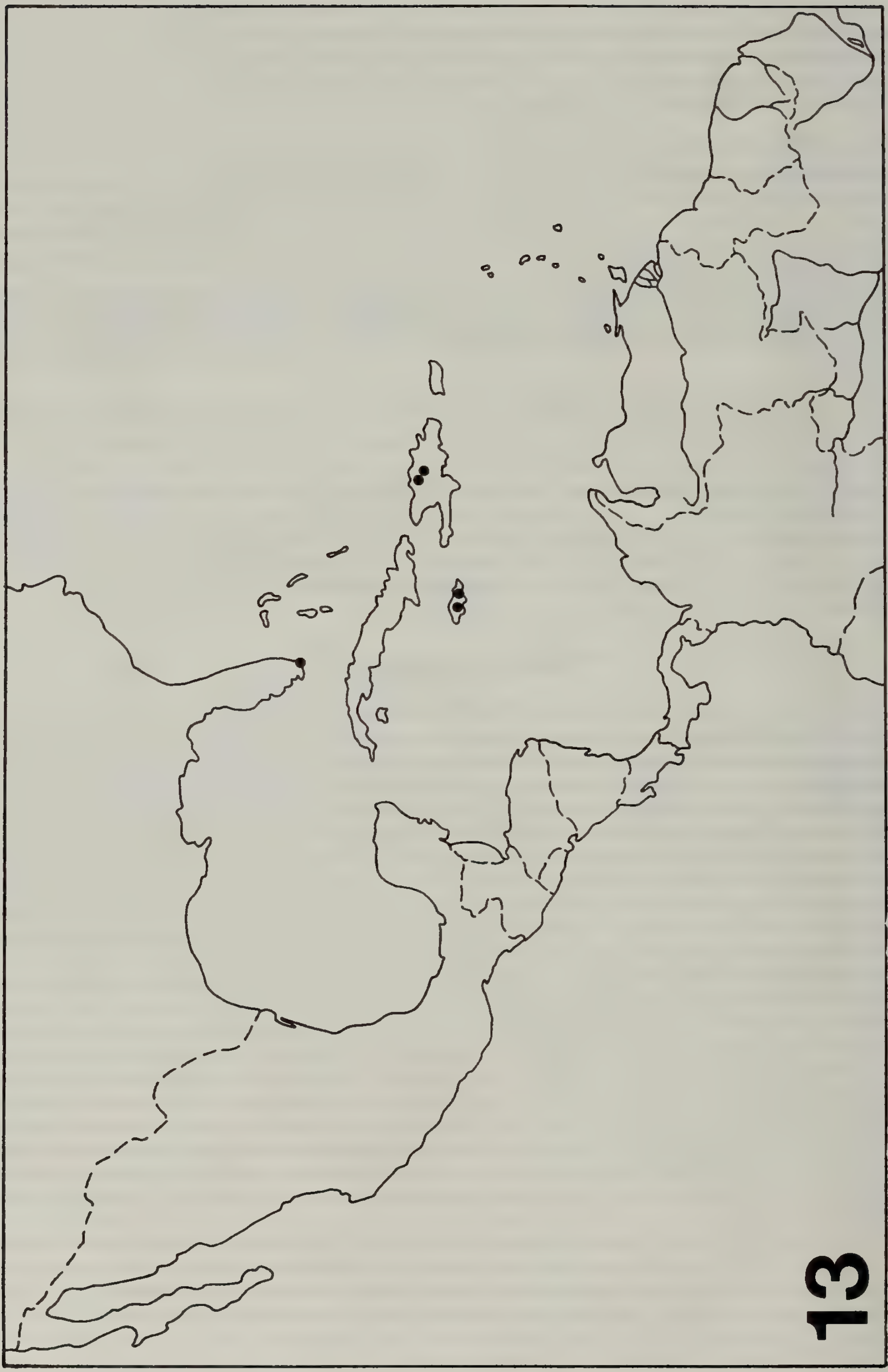
(Figs 169, 250)

DESCRIPTION. Mandibles very long, proximally strongly narrowed, distally parallel-sided, apically twisted 10–20°; upper mandibular tooth compressed, more than 3.0 times as long as the rather small lower tooth; outer mandibular surface with a deep hirsute diagonal groove extending from upper proximal corner to near base of teeth. Labrum 0.4–0.5 times as long as broad; malar space 0.3–0.4 times as long as basal mandibular width. Clypeus in profile weakly convex, margin impressed, acute; clypeus in front view 1.9–2.0 times as broad as long, the margin apically truncate. Lower face 0.81–0.88 times as broad as long, polished, centrally punctate to punctostriate. Head in dorsal view with genae rounded; posterior ocellus very close to eye; FI = 58–68%; occipital carina mediodorsally complete, ventrally curved to join hypostomal carina about 0.8 times the basal mandibular width away from mandible. Antenna moderately long, with 51–53 flagellar segments; 20th segment 1.7–2.1 times as long as broad.

Mesoscutum polished, very sparsely and shallowly punctate, in profile evenly rounded; notauli weak but discernible. Mesopleuron polished, the upper part from punctate to striate, the lower part coarsely punctostriate; epicnemial carina inclined towards anterior margin of pleuron, but with upper end evanescent. Scutellum in profile weakly convex, laterally carinate for 0.9 or more of its length; scutellum in dorsal view 1.7–1.9 times as long as anteriorly broad, finely punctate. Metapleuron characteristically flattened, coarsely irregularly punctostriate (Fig. 169); submetapleural carina evenly anteriorly broadened; posterior transverse carina of mesosternum complete. Propodeum in profile evenly declivous; anterior transverse carina medially strong, arched slightly forwards, laterally weak or evanescent; posterior transverse carina absent; anterior area moderately long, striate; spiracular area quite short, especially centrally, punctate; posterior area coarsely irregularly wrinkled; lateral longitudinal carina complete, not joined to spiracular margin by a short carina.

Fore wing length 12–14 mm; discosubmarginal cell as in Fig. 250; AI = 0.58–0.91; CI = 0.40–0.51; ICI = 0.50–0.58; SDI = 1.10–1.15; *cu-a* opposite to the base of *Rs&M* or proximal to it by about its own thickness; marginal cell proximally slightly more sparsely hirsute than centrally; 1st subdiscal cell with anterior and distal parts hirsute. Hind wing with 5–6 hamuli on *R*1; 1st abscissa of *Rs* straight, 2nd abscissa straight.

Fore leg with tibia slightly flattened, with scattered spines on outer surface. Mid leg with longer tibial spur 1.6–1.7 times length of the shorter. Hind leg with coxa in profile 1.7–1.8 times as long as deep;



Map 13 Localities at which *Enicospilus neotropicus* has been collected.

trochantellus dorsally 0.1–0.2 times as long as broad; 4th segment of tarsus 2.2–2.4 times as long as broad; claws of female large, distally quite strongly curved, with close short pectinae; claws of male similar, but with pectinae finer and closer together.

Gaster long and slender; tergite 2 in profile more than 4 times as long as posteriorly deep, laterotergite turned under, thyridia elliptical and separated from anterior margin of tergite by 2 or more times its own length. Ovipositor slender, its sheath narrow. Male with sternites 7–9 bearing fine decumbent pubescence; gonosquama obliquely truncate.

Colour generally yellowish brown; interocellar area yellow; antenna orange-brown; pterostigma yellowish; wings hyaline.

VARIATION. A few specimens have pale longitudinal stripes on the mesoscutum.

REMARKS. This species is named in honour of Doyle McKey for his enthusiasm for unravelling tropical animal-plant interactions.

The form of the mandibles and male claws indicate that *Enicospilus doylei* belongs to the *E. ramidulus* species-group. It differs most obviously from all other New World members of this group in the form of the central sclerite, which is almost kite-shaped rather than oval or D-shaped, and in having the metapleuron flattened. These are not the only autapomorphic features of this species; it has longer and more bowed mandibles than other taxa, the head is subtly shorter, and the face slightly constricted ventrally.

BIOLOGICAL INFORMATION. *Enicospilus doylei* is widely distributed throughout Florida where it occurs from the Keys to almost as far north as the Georgia State line. I have also seen a single specimen from Baton Rouge, Louisiana, so it may occur all along the northern periphery of the Gulf of Mexico. Outside of the United States *E. doylei* has also been collected in the Bahamas, and on Bermuda. On the mainland of Central America this species is only known to occur in agricultural areas in Nicaragua (Map 14). This peculiar distribution pattern suggests *E. doylei* may be associated with a synanthropic lepidopteran host, and it may have been spread by the agency of man. However, it has never been reared.

MATERIAL EXAMINED

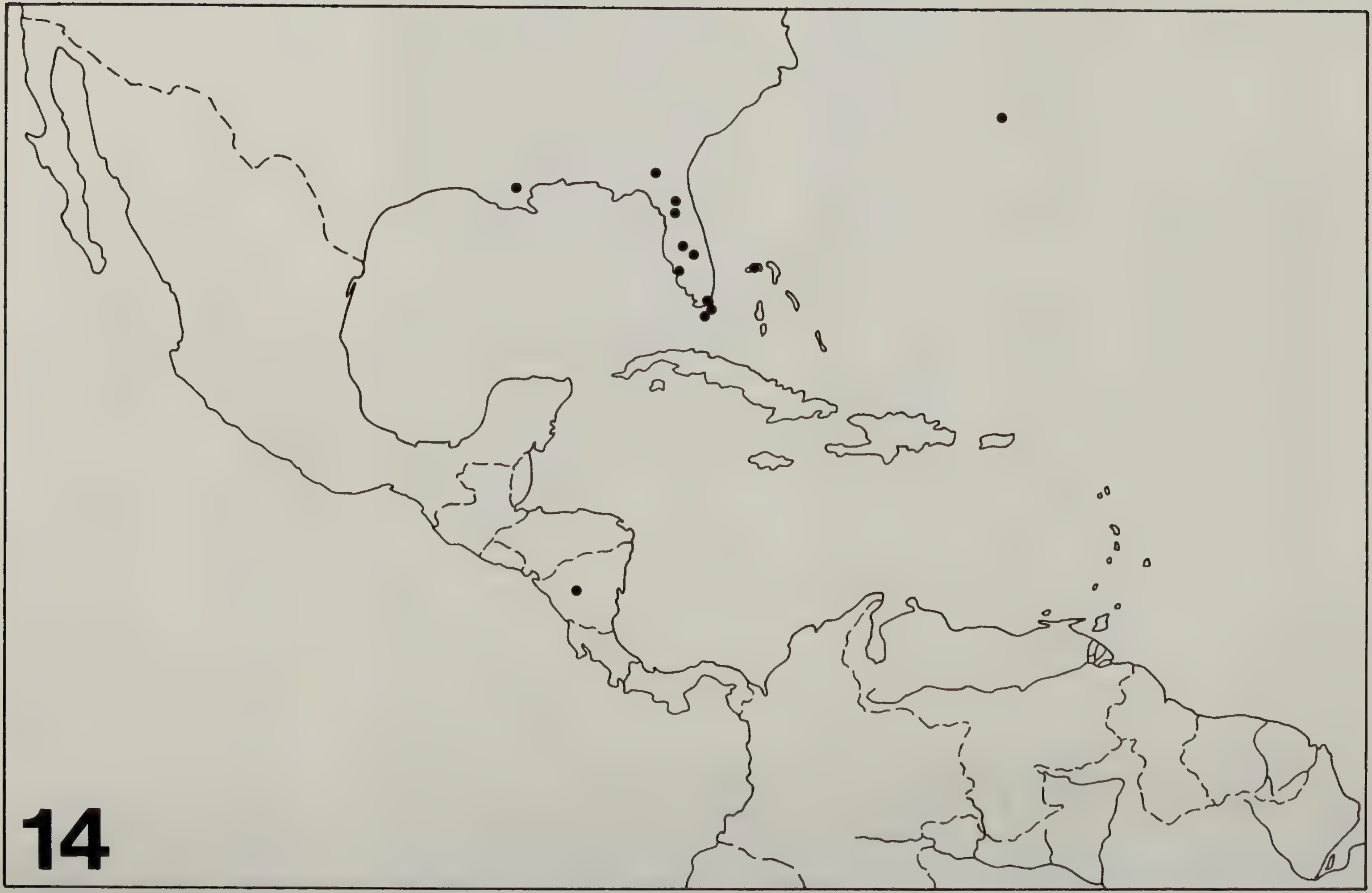
Holotype ♀, **U.S.A.**: Florida, Gadsden Co., Quincy, viii.1970 (*Hasse*) (FSCA).

Paratypes. **Bahamas**: 1 ♀, Grand Bahama Is., 8 Mile Rock, iv (*French*) (MCZ). **Bermuda**: 1 ♀, Bermuda Is., vi.1962 (*Maynard*) (TC). **Nicaragua**: 2 ♂, 3 ♀, León, vii.1985 (*Mays*) (BMNH; ULN). **U.S.A.**: Florida: 1 ♀, Alachua Co., Gainesville, iv.1952 (*Walley*) (CNC); 1 ♀, same locality, vii.1953 (*Patton*) (FSCA); 1 ♂, same locality, x.1963 (*Platt*) (FSCA); 1 ♂, same locality, vii.1969 (*Mead*) (FSCA); 2 ♀, same locality, v.1970 (*Mead*) (FSCA); 1 ♀, same locality, x.1971 (*Mead*) (FSCA); 1 ♂, same locality, i.1972 (*Mead*) (FSCA); 1 ♂, same locality, vi.1972 (*MacGowan*) (FSCA); 1 ♀, same locality, viii.1972 (*Mead*) (FSCA); 3 ♀, Dade Co., Miami, vi.1960 (*Briggs*) (FSCA); 1 ♂, 4 ♀, Gadsden Co., Quincy, vii-viii.1970 (*Hasse*) (BMNH, FSCA); 3 ♂, 2 ♀, same locality, viii.1971 (*Reid*) (FSCA); 9 ♂, 9 ♀, Highlands Co., Archbold Biological Station, i-iv.1962 (*Frost*) (TC); 3 ♀, same locality, iv.1967 (*Peterson*) (CNC); 3 ♂, 4 ♀, Highlands Co., Lake Placid, v-vi.1967 (*Heinrich*) (CNC); 2 ♂, Hillsborough Co., St Petersburg, vi.1962 (*Forsyth*) (FSCA); 1 ♀, Lake Co., Leesburg, x.1961 (*Felshaw*) (FSCA); 1 ♀, Manatee Co., Bradenton, xii.1963 (*Frederic*) (FSCA); 1 ♂, Monroe Co., Key Largo, v.1973 (*Wyles*) (FSCA); 1 ♀, Monroe Co., Key West, vi.1960 (*Warner*) (FSCA); 1 ♂, same locality, iii.1962 (*Buchanan*) (FSCA); 1 ♀, same locality and collector v.1963 (FSCA); 1 ♀, Polk Co., Winter Haven, viii.1960 (*Hayward*) (FSCA): Louisiana: 1 ♀, Baton Rouge, xi.1961 (*Arnold*) (TC).

Enicospilus purgatus (Say)

(Figs 170, 171, 251)

Ophion purgatus Say, 1836: 239. Syntypes, U.S.A. (destroyed).
Ophion lateralis Brullé, 1846: 141. Holotype ♀, U.S.A. (MNHN) [examined]. Synonymized by Hooker, 1912: 79.
Ophion flaviceps Brullé, 1846: 142. Holotype ♀, BRAZIL (MNHN) [examined]. Synonymized by Townes & Townes, 1966: 181.
Ophion volubilis Holmgren, 1868: 410. Lectotype ♂, ARGENTINA (NR) designated by Townes & Townes (1966: 181). Synonymized by Townes & Townes, 1966: 181.
[Ophion merdarius Gravenhorst; Taschenberg, 1875: 435. Misidentification.]
Henicospilus flaviceps (Brullé) Szépligeti, 1905: 27.
Henicospilus merdarius var. *volubilis* (Holmgren) Roman, 1910: 165.
Enicospilus purgatus (Say) Hooker, 1912: 79.
Enicospilus flaviceps (Brullé) Hooker, 1912: 85.



Map 14 Localities at which *Enicospilus doylei* has been collected.

Henicospilus purgatus (Say) Morley, 1912: 33.
Henicospilus volubilis (Holmgren) Morley, 1912: 34.
Enicospilus purgatus (Say); Townes, 1945: 473.
[*Henicospilus merdarius* (Gravenhorst); Schrottky, 1913: 130. Misidentification.]
[*Enicospilus merdarius* (Gravenhorst); Townes & Townes, 1966: 181. Misidentification.]
[*Enicospilus merdarius* (Gravenhorst); Carlson, 1979: 703. Misidentification.]

DESCRIPTION. Mandibles with a weakly developed proximoventral lobe, proximally abruptly narrowed, distally long, parallel-sided, apically twisted 10–20°; upper mandibular tooth cylindrical, 2.0–3.0 times as long as the lower tooth; outer mandibular surface with a diagonal furrow extending from upper proximal corner to between bases of teeth, this furrow bearing close pubescence (Fig. 171). Labrum 0.3–0.4 times as long as broad; malar space 0.4–0.5 times as long as basal mandibular width. Clypeus in profile moderately strongly convex, margin impressed, acute; clypeus in front view 1.3–1.7 times as broad as long, the apical margin truncate. Lower face 0.75–0.85 times as broad as long, polished, finely punctate. Head in dorsal view with genae fairly short, slightly swollen; posterior ocellus close to but generally not touching eye; FI = 60–70%; occipital carina mediodorsally complete, ventrally usually complete, joining hypostomal carina about 0.8 times the basal mandibular width away from mandible. Antenna moderately long and slender, with 53–57 flagellar segments; 20th segment 2.1–2.5 times as long as broad.

Mesoscutum weakly to moderately strongly polished, with fine punctures, in profile evenly rounded; notauli absent. Mesopleuron polished, the upper part finely punctate to punctostriate, the lower part more coarsely sculptured, either punctate or punctostriate; epicnemial carina curved towards anterior margin of pleuron. Scutellum in profile weakly convex, laterally carinate for 0.8 or more of its length; scutellum in dorsal view 1.5–1.7 times as long as anteriorly broad, punctate, often posteriorly wrinkled. Metapleuron weakly convex, punctate (Fig. 170); submetapleural carina evenly anteriorly broadened; posterior transverse carina of mesosternum complete. Propodeum in profile fairly evenly rounded; anterior transverse carina generally complete but with lateral extremities evanescent, posterior transverse carina absent; anterior area moderately long, strongly impressed, striate to rugose/coriaceous; spiracular area of moderate length, generally fairly smooth; posterior area finely reticulately wrinkled; lateral longitudinal carina present anteriorly, posteriorly either complete or effaced, usually joined to spiracular margin by a short carina, but this carina may be weak or absent.

Fore wing length 12–14 mm; discosubmarginal cell as in Fig. 251; AI = 0.33–0.99; CI = 0.32–0.48; ICI = 0.36–0.51; SDI = 1.19–1.31; *cu-a* proximal to the base of *Rs&M* by 0.1–0.4 times its own length, rarely virtually opposite; marginal cell proximally fairly evenly hirsute; 1st subdiscal cell with anterior 0.3 or more hirsute. Hind wing with 6–7 hamuli on *R*1; 1st abscissa of *Rs* straight, 2nd abscissa straight.

Fore leg with tibia subcylindrical, with scattered spines on outer surface. Mid leg with longer tibial spur 1.4–1.6 times length of the shorter. Hind leg with coxa in profile 1.8–2.0 times as long as deep; trochantellus dorsally 0.1–0.2 times as long as broad; 4th segment of tarsus 2.7–2.9 times as long as broad; claws of female long, distally evenly curved, fairly closely pectinate; claws of male similar, but with pectinae extremely close together.

Gaster long and slender; tergite 2 in profile more than 6 times as long as posteriorly deep, laterotergite turned under, thyridia elliptical and separated from anterior margin of tergite by about 2.5–3.5 times its own length. Ovipositor apically slender, its sheath slender. Male with sternites 7–9 bearing fine semierect pubescence; gonosquama quite long and strongly tapered, distally obliquely truncate and dorsally with margin slightly excavate.

Colour generally yellowish brown with terminal segments of gaster weakly infuscate; interocellar area, vertex, genal orbit and most of face paler yellowish; pterostigma orange; wings hyaline.

VARIATION. Despite the fact that *Enicospilus purgatus* has an extensive geographical range it is a remarkably morphological uniform species. The most striking variation is in density of the punctures on the metapleuron. In most specimens these punctures are very close, but isolated individuals from many areas may have them small and scattered. There is comparatively little variation in the form of the alar sclerites though a few individuals may have the distal sclerite either more or less heavily sclerotized than the figure. The central sclerite varies in shape from circular to D-shaped though occasional specimens have the distal side angularly rounded.

There are in the BMNH a few females from various localities (including Costa Rica) which seem to belong to this species except that they are rather larger with a fore wing length of up to 18 mm and possess up to 69 flagellar segments. In other features these individuals are typical of the species.

Amongst material in North American institutions I have seen a number of specimens which are structurally unusual for this species. I have not investigated these further, and it is possible that several Nearctic species may be confused under the name *purgatus*. These do not occur in the Neotropics.

REMARKS. *Enicospilus purgatus* has been considered to be synonymous with the Palaearctic species *E. merdarius* (Gravenhorst) and treated under that name in several catalogues (e.g. Townes & Townes, 1966; Carlson, 1979). However, it is noteworthy that the name *merdarius* is actually a junior synonym of *E. ramidulus* (L.) (see Townes *et al.*, 1965), and thus, if one were to treat the New World species as being conspecific with the Old World one, the name *ramidulus* should be used

However, I am not certain that the New and Old World species are indeed conspecific, as they differ subtly, but consistently, in the shape of the alar sclerites and in the density of the thoracic punctures. Structurally they are otherwise very similar and both seem to parasitize similar hosts, but then many other members of the *ramidulus* species-group (including the Old World tropical species *E. capensis*) are morphologically similar and parasitize noctuids in agroecosystems. It is possible to reliably separate 'typical' members of each of the nominal species *E. purgatus*, *E. ramidulus* and *E. capensis*, but the ranges of variation do somewhat overlap, making definition of the species difficult. At present I believe that the best course of action is to treat the New World species (*E. purgatus*) as distinct from the temperate (*E. ramidulus*) and tropical (*E. capensis*) Old World ones.

E. purgatus is the commonest New World species of the *E. ramidulus* (= *capensis*) species-group, a complex of species characterized by possessing a long, diagonally grooved mandible and strongly sexually dimorphic claws (those of the male have extremely fine, close pectination). *E. purgatus* may easily be separated from other Neotropical species by the characters given in the key

E. purgatus is obviously very closely related to several Old World species (including *E. ramidulus* and *E. capensis*), and it seems reasonable to regard the position and number of alar sclerites, and the general sculpture of this complex of species as representing the plesiomorphic condition for the species-group, because they share these features with their sister-group, the *E. antefurcalis* species-group (Gauld, 1982). Assuming that *E. purgatus* is the most plesiomorphic of the New World species of the *ramidulus* species-group, all the others can be regarded as having arisen from it. *E. neotropicus* is distinguished by having lost the central sclerite, whilst *E. doylei* has acquired a specialized flattened metapleuron and a modified central sclerite. The endemic Galapagos *E. vidor* species-complex is characterized by the possession of fine thoracic sculpture and by the reduction of the alar sclerites (Gauld & Carter, 1983). Various other, undescribed, South American species can similarly be assumed to have been derived from *E. purgatus*, leaving *E. purgatus*, as it is here recognized, as a 'paraphyletic species'.

BIOLOGICAL INFORMATION. *Enicospilus purgatus* is a very widely distributed species whose range extends from northern Canada throughout virtually the entire United States, the Caribbean, and Central America, south to Argentina. However, it seems to be uncommon in many tropical areas of South America, and it is apparently absent from Chile, where it seems to be replaced by a related but undescribed species which has a stouter head. Throughout most of its range *E. purgatus* seems to be most common in disturbed habitats and agricultural areas.

E. purgatus is a relatively infrequently collected species in much of Costa Rica. I have seen isolated specimens from Tortuguero National Park in Limón Province and Monteverde Reserve in Puntarenas Province, but most specimens have been collected in Santa Rosa National Park in Guanacaste Province, or on the periphery of the park in disturbed areas, notably on the Cerro el Hacha, and at Estacion Mengo. At these sites most individuals have been collected between May and July during the earlier part of the wet season. Further north, in the agricultural lowlands of Nicaragua, *E. purgatus* is one of the most commonly collected species in the genus. It might be widespread and common in lowland agricultural areas throughout Central America; it is just that few people have ever light-trapped in such bleak areas! No specimens of *E. purgatus* have been collected in lowland forest sites such as Barro Colorado Island.

E. purgatus is known to parasitize a variety of noctuid larvae that feed on rather low-growing vegetation. In the Neotropical region it is recorded as a parasitoid of the following species of Noctuidae: *Alabama argillacea* (Hübner), *Faronta albilinea* (Hübner), *Helicoverpa zea* (Boddie), *Mythimna unipuncta* (Haworth), *Peridromia saucia* (Hübner), *Spodoptera frugiperda* (Smith & Abbott) and *Spodoptera ornithogalli* (Guenée) (Gowdey, 1926; Blanchard, 1940; Bruner *et al.*, 1945; Costa Lima, 1962). Townes (1945) and Carlson (1979) list North American host records, but several of these must be regarded with suspicion as this species has previouly been confused with other *Enicospilus*. I have seen no authenicated examples of *E. purgatus* reared from the larvae of Notodontidae, Sphingidae or Saturniidae.

Oviposition seems to be into half-grown larvae, and the parasitoid larva emerges after the host larva has ceased to feed. The parasitoid cocoon is usually found in the soil or in leaf-litter.

MATERIAL EXAMINED

Holotype ♀ (*Ophion flaviceps* Brullé), **Brazil** (MNHN).

286 ♂, 339 ♀, from the following localities- **Anguilla; Antigua; Argentina** (Buenos Aires, Chaco, Tucumán); **Barbados; Bermuda; Bolivia** (Santa Cruz); **Brazil** (Paraná, Santa Catarina); **Canada** (most

provinces); **Cayman Islands** (Grand Cayman); **Colombia** (Valle); **Costa Rica** (Guanacaste, Limón and Puntarenas Provinces); **Cuba; Dominica; Dominican Republic** (Altagracia); **Ecuador** (Esmeraldas, Pichincha); **Guyana; Jamaica; Mexico** (Baja California, Chiapas, Chihuahua, Durango, Sinaloa, Sonora, Veracruz); **Nicaragua** (León); **Panama** (Canal Zone); **Puerto Rico; Peru** (La Libertad, Lima, Loreto); **Saint Vincent; Surinam; Trinidad; U.S.A.** (almost all states); **Venezuela** (Miranda, Sucre); **Virgin Islands.**

Enicospilus luquillo sp. n.

(Fig. 252)

Description. Mandibles moderately long, proximally moderately narrowed, distally almost parallel-sided, apically twisted 10–20°; upper mandibular tooth slender, subcylindrical, 1.3–1.6 times as long as the lower tooth; outer mandibular surface centrally very slightly concave, finely pubescent, with a very weak proximal concavity. Labrum 0.3 times as long as broad; malar space 0.4 times as long as basal mandibular width. Clypeus in profile weakly convex, margin inturned, blunt; clypeus in front view 1.3–1.6 times as broad as long, with margin weakly convex. Lower face 0.75–0.78 times as broad as long, centrally finely punctate. Head in dorsal view with genae evenly constricted behind eyes; posterior ocellus close to eye; FI = 65–70%; occipital carina mediodorsally complete, ventrally curved to join hypostomal carina about 1.0 times the basal mandibular width away from mandible. Antenna long and slender, with 65–68 flagellar segments; 20th segment 2.1–2.3 times as long as broad.

Mesoscutum polished, sparsely punctate, in profile evenly rounded; notauli vestigial. Mesopleuron polished, the upper and lower parts alutaceous; epicnemial carina evenly curved towards anterior margin of pleuron. Scutellum in profile weakly convex, laterally carinate for 0.8 or more of its length; scutellum in dorsal view 1.6–1.7 times as long as anteriorly broad, sparsely and shallowly punctate. Metapleuron weakly convex, virtually smooth; submetapleural carina evenly anteriorly broadened; posterior transverse carina of mesosternum complete or rarely with a very narrow median discontinuity. Propodeum in profile evenly declivous; anterior transverse carina complete, posterior transverse carina absent; anterior area striate; spiracular area moderately long, finely punctate; posterior area irregularly wrinkled, centrally with the wrinkles tending to be longitudinal; lateral longitudinal carina usually complete, joined to spiracular margin by a short carina.

Fore wing length 17–18 mm; discosubmarginal cell as in Fig. 252; AI = 0.47–0.61; CI = 0.34–0.36; ICI = 0.52–0.58; SDI = 0.98–1.02; *cu-a* proximal to base of *Rs&M* by about 0.2 times its own length; marginal cell proximally evenly hirsute; 1st subdiscal cell anteriorly rather sparsely but distally broadly hirsute. Hind wing with 7–8 hamuli on *R*1; 1st and 2nd abscissae of *Rs* straight.

Fore leg with tibia slightly flattened, with scattered fine spines on outer surface. Mid leg with longer tibial spur 1.2–1.5 times as long as the shorter. Hind leg with coxa in profile 1.8–1.9 times as long as deep; trochantellus dorsally 0.1 times as long as broad; 4th segment of hind tarsus 2.6–2.7 times as long as broad; claws of female with short, stout pectinae, those of male similar.

Gaster slender; tergite 2 in profile more than 6 times as long as posteriorly deep, laterotergite folded under, thyridia elliptical, separated from anterior margin of tergite by 3–4 times its own length. Ovipositor slender, its sheath narrow. Male with sternites 7–9 bearing dense long fine semierect pubescence; gonosquama distally acutely rounded.

Colour generally yellowish, sometimes with mesoscutum darker, rarely with mesoscutum with three dark longitudinal vittae; interocellar area yellow; antenna yellowish; pterostigma golden; wings hyaline.

Variation. The only unusual variation exhibited by the specimens at hand is in the colour of the mesoscutum as detailed above.

Remarks. This species is named after the Luquillo National Forest, a unique and endangered habitat.

Enicospilus luquillo is immediately recognizable by the highly modified, apomorphic alar sclerites (Fig. 252). It otherwise closely resembles *E. flavoscutellatus* and may have arisen from this species by becoming geographically isolated on Puerto Rico, the only place it is known to occur.

Biological Information. *Enicospilus luquillo* is only known to occur in forests on the island of Puerto Rico. No details of its biology are known.

Material Examined

Holotype ♀, **Puerto Rico**: Luquillo Forest, El Yunque Biology Station, 700 m, i.1963 (*Spangler & Spangler*) (USNM).

Paratypes. **Puerto Rico**: 1 ♀, Barranquitas, vi.1969 (*Flint*) (USNM); 1 ♀, Catano, x.1943 (USNM); 1 ♀, Gurabo, xi.1914 (USNM); 2 ♀, Luquillo Forest, El Yunque Biology Station, 700 m, i.1963 (*Spangler & Spangler*) (BMNH, USNM); 1 ♂, same locality, vii.1969 (*Howden*) (CNC); 1 ♀, Santa Rita, xii.1913 (*Merrill*) (FSCA).

Enicospilus martae sp. n.

(Fig. 253)

DESCRIPTION. Mandibles moderately long, fairly evenly narrowed, apically twisted 30–40°; upper mandibular tooth slightly compressed, 0.7–0.8 times as long as the lower tooth; outer mandibular surface centrally flat with isolated fine hairs, and with a weak proximal concavity. Labrum 0.2 times as long as broad; malar space 0.4 times as long as basal mandibular width. Clypeus in profile weakly convex, margin rather sharp; clypeus in anterior aspect 1.5–1.6 times as broad as long, with margin weakly convex. Lower face 0.70–0.75 times as broad as long, centrally closely punctate, fairly weakly polished. Head in dorsal view with genae rounded; posterior ocellus contiguous with eye; FI = 60–65%; occipital carina mediodorsally complete, ventrally curved to join hypostomal carina about 0.8–0.9 times the basal mandibular width away from mandible. Antenna slender with 64–65 flagellar segments; 20th segment 2.3–2.4 times as long as broad.

Mesoscutum polished, finely punctate, in profile steeply rounded; notauli weak but discernible. Mesopleuron polished, the upper part with obsolescent punctures, the lower part similar but with area between punctures finely alutaceous; epicnemial carina inclined towards but not reaching anterior margin of pleuron. Scutellum in profile weakly convex, laterally carinate for most of its length, but posteriorly the carinae are rather weak; scutellum in dorsal view 1.5–1.6 times as long as anteriorly broad, polished with fine scattered punctures. Metapleuron alutaceous, with close weak punctures; submetapleural carina weakly anteriorly broadened; posterior transverse carina of mesosternum complete. Propodeum in profile evenly declivous; anterior transverse carina complete, posterior transverse carina absent; anterior area quite deeply impressed, irregularly wrinkled; spiracular area of moderate length, smooth; posterior area coriaceous; lateral longitudinal carina complete, joined to spiracular margin by a short carina.

Fore wing length 15–17 mm; discosubmarginal cell as in Fig. 253; AI = 0.60–0.97; CI = 0.33–0.39; ICI = 0.61–0.66; SDI = 1.21–1.25; *cu-a* slightly proximal to base of *Rs&M*; marginal cell sparsely hirsute proximally; 1st subdiscal cell hirsute anteriorly and distally. Hind wing with 6–7 hamuli on *R*1; 1st abscissa of *Rs* weakly curved, 2nd abscissa almost straight.

Fore leg with tibia weakly flattened, with scattered fine spines on outer surface. Mid leg with longer tibial spur 1.5–1.6 times the length of the shorter. Hind leg with coxa in profile 1.8–1.9 times as long as deep; hind trochantellus in dorsal view about 0.1 times as long as broad; 4th segment of hind tarsus 2.3–2.4 times as long as wide; hind tarsal claws of female with short stout pectinae, those of male similar but with pectinae closer and finer.

Gaster long and slender; tergite 2 in profile about 6 times as long as posteriorly deep, its laterotergite folded under and with elliptical thyridium separated from anterior margin of tergite by about 3 times its own length. Ovipositor slender, its sheath narrow. Male with sternites 7–9 bearing dense long erect pubescence; gonosquama truncated.

Colour generally yellowish, mesoscutum with three dark longitudinal vittae; interocellar area pale yellow; antenna proximally black, distally paler; pterostigma brownish yellow; wings hyaline.

VARIATION. None noteworthy.

REMARKS. This species is named in honour of Marta Boza in recognition of her contributions to Costa Rican conservation biology.

Enicospilus martae is obviously very closely related to *E. columbianus*, which it resembles in having the mandibles unusually modified, with the lower tooth distinctly the longer. The two are probably sister-species. *E. martae* may be recognized on account of its larger size, longer antennae and larger ICI as well as by differences in the alar sclerites (compare Figs 253 and 254).

BIOLOGICAL INFORMATION. *Enicospilus martae* is a Central American species whose range is only known to extend from Costa Rica south to central Panama. It has only been collected in wet forests from near sea-level up to about 750 m. Its host is unknown.

MATERIAL EXAMINED

Holotype ♂, **Panama**: Barro Colorado Island, xii.1984 (*Wolda*) (BMNH).

Paratypes. **Costa Rica**: Guanacaste Prov.: 1 ♂, Rincón de la Vieja National Park, 4 km E. of Casetilla, 750 m, xii.1981 (*Janzen & Hallwachs*) (BMNH). **Panama**: 1 ♀, Barro Colorado Island, vi.1985 (*Wolda*) (BMNH).

Enicospilus columbianus (Enderlein)

(Figs 172, 254)

Henicospilus columbianus Enderlein, 1921: 32. Holotype ♀, COLOMBIA (IZPAN) [examined].
Enicospilus columbianus (Enderlein) Townes & Townes, 1966: 176.

DESCRIPTION. Mandibles moderately short, fairly evenly narrowed, apically twisted 10–20°; upper mandibular tooth subcylindrical, 0.7–0.8 times as long as the lower tooth (Fig. 172); outer mandibular surface centrally flat, with a weak proximal concavity. Labrum 0.2 times as long as broad; malar space 0.4 times as long as basal mandibular width. Clypeus in profile weakly convex, margin rather sharp; clypeus in front view 1.5–1.6 times as broad as long, with margin weakly convex. Lower face 0.70–0.75 times as broad as long, centrally closely punctate, fairly weakly polished. Head in dorsal view with genae rounded; posterior ocellus contiguous with eye; FI = 60–65%; occipital carina mediodorsally complete, ventrally curved to join hypostomal carina about 0.8–0.9 times the basal mandibular width away from mandible. Antenna slender with 55–60 flagellar segments; 20th segment 2.3–2.4 times as long as broad.

Mesoscutum polished, finely punctate, in profile steeply rounded; notauli vestigial. Mesopleuron polished, the upper part with obsolescent punctures, the lower part similar but with area between punctures finely alutaceous; epicnemial carina inclined towards but not reaching anterior margin of pleuron. Scutellum in profile weakly convex, laterally carinate for most of its length, but posteriorly the carinae are rather weak; scutellum in dorsal view 1.5–1.6 times as long as anteriorly broad, polished with fine scattered punctures. Metapleuron with close weak punctures; submetapleural carina weakly anteriorly broadened; posterior transverse carina of mesosternum complete. Propodeum in profile evenly declivous; anterior transverse carina complete, posterior transverse carina absent; anterior area irregularly wrinkled; spiracular area quite long, smooth; posterior area coriaceous, somewhat more weakly sculptured than is usual for species of this genus; lateral longitudinal carina complete, sometimes joined to spiracular margin by a short carina.

Fore wing length 11–13 mm; discosubmarginal cell as in Fig. 254; AI = 0.52–1.25; CI = 0.15–0.39; ICI = 0.28–0.44; SDI = 1.10–1.16; *cu-a* from opposite to slightly proximal to *Rs&M*; marginal cell proximally very slightly more sparsely hirsute than it is centrally, sometimes narrowly glabrous; 1st subdiscal cell with sparse, scattered hairs. Hind wing with 6–7 hamuli on *R*1; 1st and 2nd abscissae of *Rs* straight.

Fore leg with tibia subcylindrical, with numerous spines on outer surface. Mid leg with longer tibial spur 1.6–1.8 times length of the shorter. Hind leg with coxa in profile 1.8–1.9 times as long as deep; trochantellus dorsally 0.2 times as long as broad; 4th segment of tarsus 2.1–2.3 times as long as broad; claws of female quite long with close long pectinae, those of male with pectinae short and stout.

Gaster slender; tergite 2 in profile at least 5 times as long as posteriorly deep, laterotergite turned under, thyridia elliptical and separated from anterior margin of tergite by 2–4 times its own length. Ovipositor slender, its sheath moderately slender. Male with sternites 7–9 bearing scattered long erect hairs; gonosquama distally from quite evenly rounded to subtruncate.

Colour generally yellowish brown, mesoscutal vittae blackish; interocellar area yellow, usually with a small blackish mark between the posterior ocelli; antenna blackish; pterostigma yellowish brown; wings hyaline.

VARIATION. The female from Tabasco, Mexico is rather distinctive and may represent a separate species. It has a slightly stouter mandible, and the central sclerite is of similar shape but rotated so its longest axis is at 45° to *Rs+2r*, rather than at 90° to this vein.

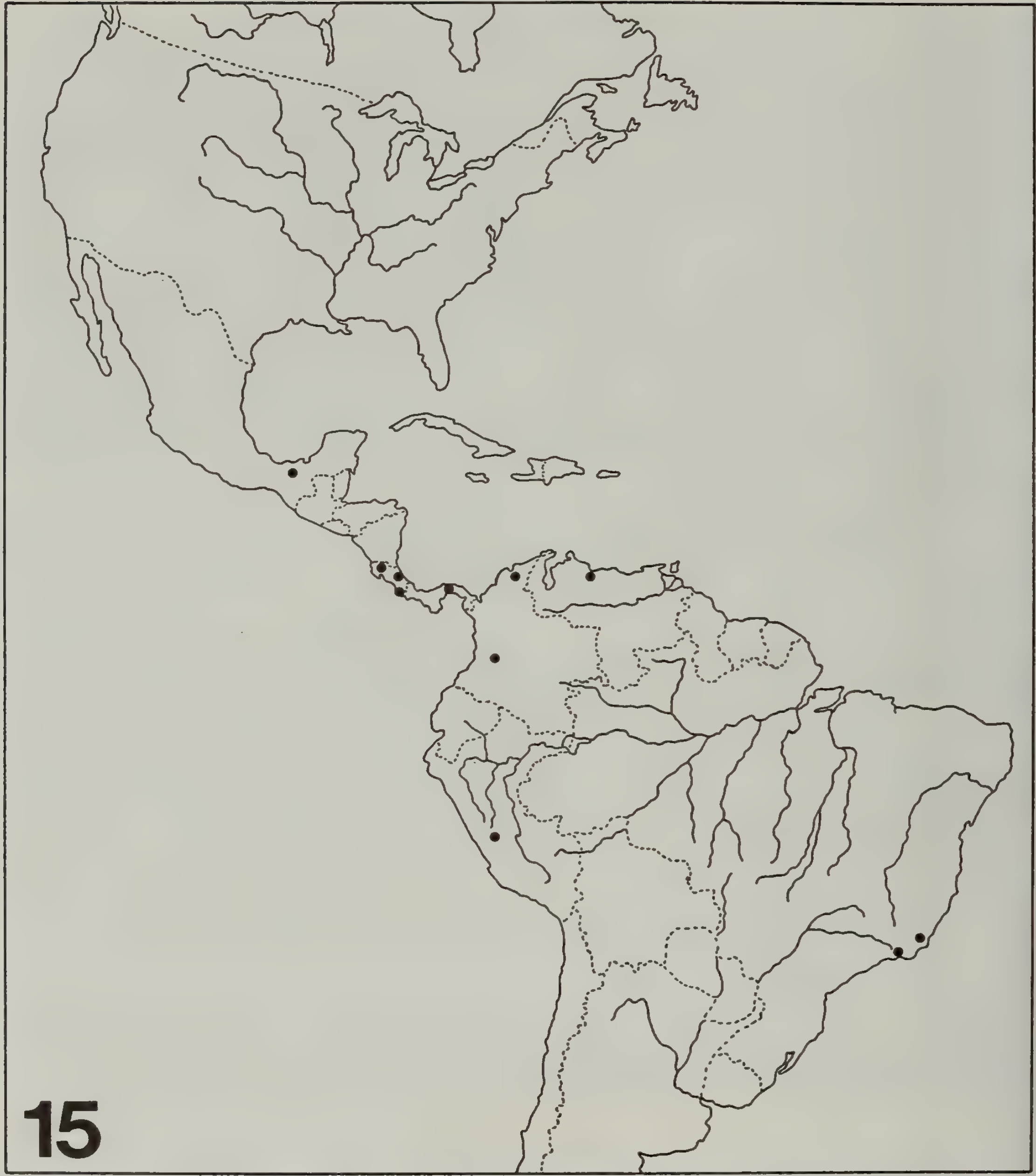
REMARKS. *Enicospilus columbianus* is one of only two species in Central America (the other being *E. martae*) that have the lower tooth of the mandible substantially longer than the upper. *E. columbianus* also resembles *E. martae* in having a rather quadrate gonosquama and in having similarly pubescent posterior sternites in the male. *E. columbianus* differs from *E. martae* in being smaller, having shorter antennae and a smaller ICI as well as by differences in the alar pubescence and sclerites (compare Figs 253 and 254).

BIOLOGICAL INFORMATION. *Enicospilus columbianus* is widely distributed from about 18°N in Tabasco, southern Mexico south to about 23°S in Brazil (Map 15). Most specimens have been collected in lowland sites, and despite extensive collecting it has never been taken at Monteverde, Costa Rica (1350 m). Generally only isolated specimens are ever to be collected in one locality. Between 1980 and 1985 three were collected in Santa Rosa National Park, Costa Rica, and three years light-trap samples (1983–5) from Barro Colorado Island, Panama, yielded two further specimens. In Santa Rosa the specimens were collected between June and July (early wet season), whilst in lowland rainforest sites, such as Corcovado National Park, Costa Rica, and on Barro Colorado Island, isolated individuals have been collected between May and August. No details of the biology of this species are known.

MATERIAL EXAMINED

Holotype ♀, **Colombia**: Rio Magdalena (*Pehlke*) (IZPAN).

Brazil: 1 ♀, Rio de Janeiro, iii.1966 (*Townes*) (TC); 1 ♀, Vila Vera, x.1973 (*Alvarenga*) (TC). **Colombia**: 1 ♂, Valle, Anchicaya, vii.1970 (*Howden*) (TC). **Costa Rica**: Cartago Prov.: 1 ♀, Turrialba, viii.1983



Map 15 Localities at which *Enicospilus columbianus* has been collected.

(*Porter*) (MCZ): Guanacaste Prov.: 2 ♀, Santa Rosa National Park, 300 m, vi-vii.1984 (*Janzen & Hallwachs*) (BMNH); 1 ♂, same locality, vi.1985 (*Gauld*) (BMNH): Puntarenas Prov.: 1 ♂, Sirena, Corcovado National Park, viii.1980 (*Janzen & Hallwachs*) (BMNH). **Mexico**: Tabasco: 1 ♀, Teapa, iii.1904 (*Godman-Salvin*) (BMNH). **Panama**: 1 ♂, Barro Colorado Island, vi.1978 (*Wolda*) (RNH); 2 ♀, same locality, v.1983, vii.1984 (*Wolda*) (BMNH). **Peru**: 1 ♀, Satipo, vii.1943 (*Paprzyck*) (TC). Venezuela: 1 ♂, 1 ♀, nr Puerto Cabello, xi-xii.1939 (*Anduze*) (TC).

Enicospilus cubensis (Norton)

(Figs 255, 278)

Ophion cubensis Norton, 1863: 358. LECTOTYPE ♂, CUBA (PANS), here designated [examined].
Enicospilus cubensis (Norton) Ashmead, 1900b: 270.
Henicospilus cubensis (Norton) Morley, 1912: 33.
Enicospilus cubensis (Norton); Townes, 1946: 47.

DESCRIPTION. Mandibles quite long, weakly and evenly narrowed, apically twisted 10–20°; upper mandibular tooth slightly compressed, about 2.0 times as long as the lower tooth; outer mandibular surface centrally more or less flat, with scattered pubescence, and with a strong proximal concavity. Labrum 0.3–0.4 times as long as broad; malar space 0.3–0.4 times as long as basal mandibular width. Clypeus in profile moderately convex, margin apparently blunt, but extreme margin narrowly impressed; clypeus in front view 1.3–1.4 times as broad as long, with margin very weakly convex. Lower face 0.65–0.70 times as broad as long, with obsolescent fine punctures. Head in dorsal view with genae constricted behind eyes; posterior ocellus very close to eye; FI = 65–70%; occipital carina mediodorsally complete, ventrally curved to join hypostomal carina about 1.0 times the basal mandibular width away from mandible. Antenna long and slender, with 60–66 flagellar segments; 20th segment 2.4–2.5 times as long as broad.

Mesoscutum weakly to strongly polished, finely punctate, in profile evenly rounded; notauli virtually indistinguishable. Mesopleuron polished, the upper part rather sparsely punctate, the lower part, at least in part striately wrinkled; epicnemial carina curved or inclined towards anterior margin of pleuron. Scutellum in profile weakly convex, laterally carinate for all of its length; scutellum in dorsal view 1.6–1.9 times as long as anteriorly broad, relatively smooth. Metapleuron closely and shallowly punctate to punctostriate to rather irregularly wrinkled; submetapleural carina evenly but very weakly broadened anteriorly; posterior transverse carina of mesosternum strong, complete. Propodeum in profile evenly rounded; anterior transverse carina more or less complete, posterior transverse carina absent; anterior area long, rather shallowly impressed, striate; spiracular area smooth; posterior area coriaceous to finely reticulate; lateral longitudinal carina present anteriorly, often complete, sometimes joined to spiracular margin by a weak short carina, sometimes without a carina.

Fore wing length 12–14 mm; discosubmarginal cell as in Figs 255, 278; AI = 0.92–1.38; CI = 0.30–0.40; ICI = 0.32–0.44; SDI = 1.15–1.25; *cu-a* more or less opposite the base of *Rs&M*; marginal cell proximally slightly more sparsely hirsute, often narrowly glabrous adjacent to *Rs+2r*; 1st subdiscal cell with anterior 0.7 and distal end hirsute. Hind wing with 5–7 hamuli on *R*1; 1st abscissa of *Rs* more or less straight, 2nd abscissa straight.

Fore leg with tibia slightly flattened, with scattered, fine spines on outer surface. Mid leg with longer tibial spur 1.3–1.4 times length of the shorter. Hind leg with coxa in profile 1.7–1.9 times as long as deep; trochantellus dorsally 0.1 times as long as broad; 4th segment of tarsus 2.4–2.7 times as long as broad; claws of female with long stout pectinae, of male similar with pectinae slightly shorter.

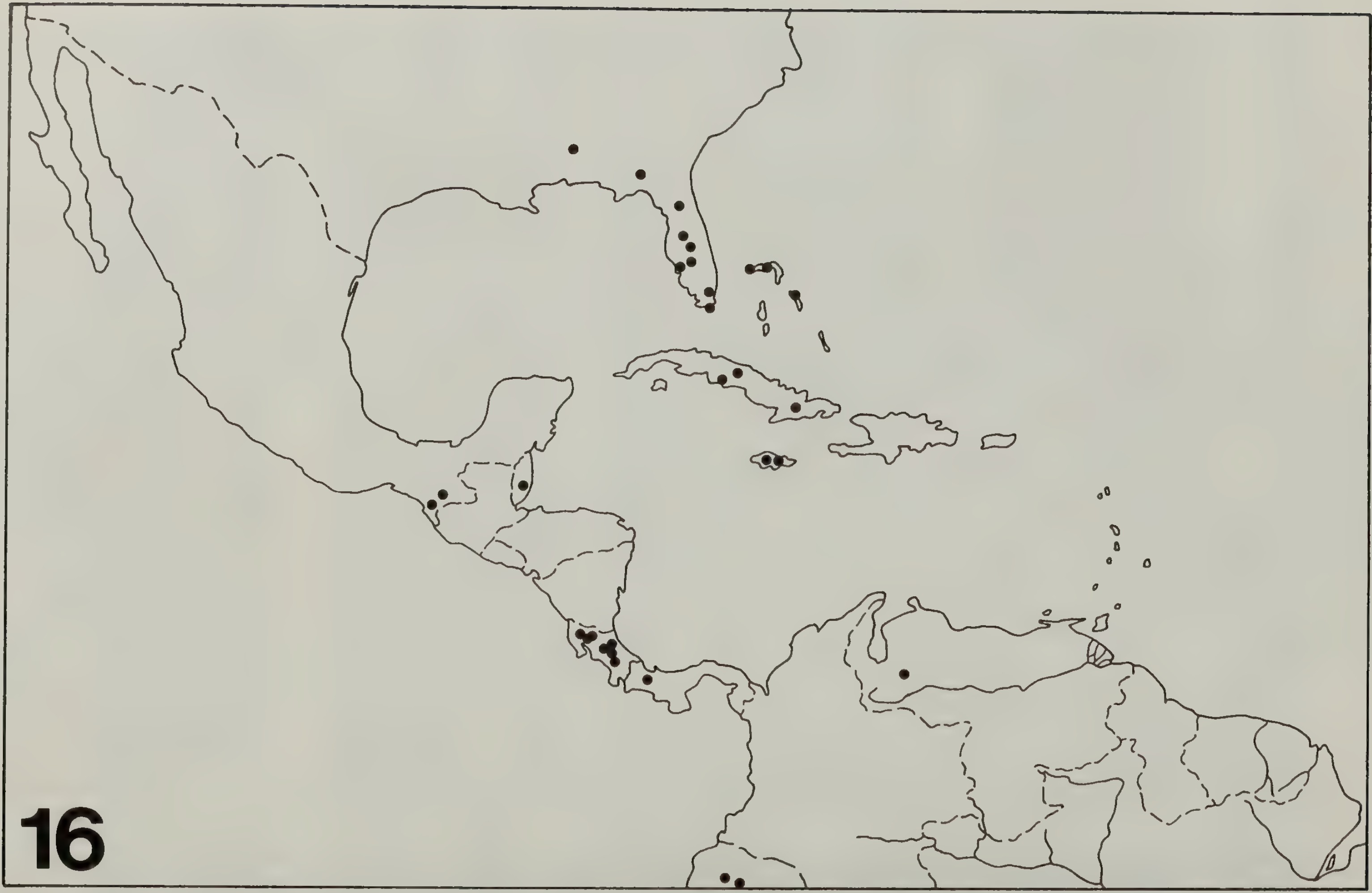
Gaster slender; tergite 2 in profile more than 6 times as long as posteriorly deep, laterotergite narrow, membranous, generally pendant, thyridia elliptical, separated from anterior margin of tergite by about 4–6 times its own length. Ovipositor slender, its sheath narrow. Males with sternites 7–9 bearing fine semierect pubescence; aedeagus apically simply rounded; gonosquama rather elongately rounded.

Colour generally yellowish, usually with the posterior segments of the gaster black; interocellar area usually black; antenna yellowish or orange, sometimes distally infuscate; pterostigma brownish; wings more or less hyaline.

VARIATION. *Enicospilus cubensis* shows a considerable range of variation in the colour of the interocellar area. Specimens from Florida in the U.S.A. and Cuba often have this almost entirely yellow though in many examples it is slightly infuscate. In Costa Rican specimens this area is black. Some Floridan and Cuban specimens have the gaster entirely yellowish. There is also a considerable variation in the sculpture of the alitrunk laterally. All specimens seen have some longitudinal wrinkling on the mesopleuron, but the extent of this area is variable, and at its greatest the entire ventral half of the pleuron is so sculptured.

Most specimens have a second very faint curved central sclerite in the fenestra. This sclerite together with the more clearly defined central sclerite form a medioventrally interrupted U-shape. In some specimens the second sclerite is quite strongly pigmented.

REMARKS. Cresson (1928) published a collective designation of lectotypes for many ichneumonid species in the Philadelphia Academy of Natural Sciences. Such collective designations are not valid under the *Code* (Art. 74c) and, as no subsequent author has validly designated a lectotype for this species, I designate one here. I have selected the specimen labelled as type by Cresson (type number 79 in PANS). This is a male from 'Cuba O.S.' There are no other definite syntypes in the Norton collection, but three unlabelled



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Map 16 Localities at which *Enicospilus cubensis* has been collected.

specimens may be syntypic. However, these cannot positively be identified as authentic Norton material. Cresson (1928: 15) stated that the specimen he labelled as type was female, but this is incorrect.

Enicospilus cubensis is an extremely distinctive species on account of the unique form of its alar sclerites (see Fig. 255). It is probably closely related to *E. trilineatus* which it resembles in possessing the following specialized features: a pendant membranous laterotergite 2; and a rather long clypeus. The aedeagus is not flanged, unlike those of some taxa in the *E. trilineatus* species-group.

Biological Information. *Enicospilus cubensis* is a very widely distributed species whose cumulative range extends from Florida throughout the Caribbean and Central America, south to Venezuela and Ecuador (Map 16). The most northern record I have seen is of a single female collected in Opelika, Alabama (32.5°N); all other U.S. records to hand are from Florida south of 30°N.

This species is most commonly encountered in disturbed habitats such as on the edges of agricultural areas and in suburban gardens. It is very uncommon in pristine forest habitats, and, despite intensive collecting, it has not been collected on Barro Colorado Island, Panama. In Costa Rica *E. cubensis* is widely distributed, but it is most common in disturbed mid altitude sites between 600 and 1400 m (e.g. at Monteverde or San Antonio de Escazú). In the seasonally dry forests of Santa Rosa National Park, lowland Guanacaste, this species is seldom collected and despite intensive collecting only isolated specimens have been taken in January, May and June.

Although this species is common around agricultural areas it has never been reared and no hosts are known.

Material Examined

Lectotype ♂, **Cuba**: 'O.S.' (PANS).

Bahamas: 1 ♀, Eleuthera, Rainbow Bay, v.1984 (*Wiley*) (FSCA); 1 ♂, Grand Bahama, Pine Ridge, v.1953 (*Hayden & Giovannoli*) (USNM); 1 ♀, Grand Bahama, West End, v.1953 (*Hayden & Giovannoli*) (USNM). **Belize**: 1 ♀, W. Highway, mile 15, vi.1968 (*Hasse*) (FSCA). **Costa Rica**: Alajuela Prov.: 1 ♂, 2 ♀, Finca Campana, 5 km NW. Dos Ríos, 750 m, iii.1985 (*Janzen & Hallwachs*) (BMNH); 1 ♀, Finca San Gabriel, 16 km ENE. Quebrada Grande, 650 m, v.1984 (*Janzen & Hallwachs*); 1 ♀, same locality, vi.1986 (*Gauld*) (BMNH); 2 ♀, San Ramón Reserve, Río San Lorencito, 800 m, ii-iii.1987 (*Chacon*) (BMNH); 1 ♀, 8.2 km N. of Vara Blanca, iv.1984 (*Janzen & Hallwachs*) (BMNH): Guanacaste Prov.: 1 ♀, Cerro el Hacha, 3–400 m, xi.1986-i.1987 (*Janzen & Hallwachs*) (BMNH); 1 ♀, Rincón de la Vieja National Park, 4 km E of Casetilla, 750 m, ii.1982 (*Janzen & Hallwachs*) (BMNH); 1 ♂, Santa Rosa National Park, 300 m, v. 1980 (*Janzen & Hallwachs*) (TC); 1 ♀, same locality and collectors, i.1982 (BMNH); 1 ♀, same locality and collectors, v.1985 (BMNH); 2 ♀, same locality, vi.1985 (*Gauld*) (BMNH): Puntarenas Prov.: 3 ♀, Monteverde 1350 m, ii.1962 (*Palmer*) (TC); 1 ♀, same locality and collector, ix.1962 (TC); 1 ♀, same locality, ii. 1963 (*Rettenmeyer*) (TC); 2 ♀, same locality, ii.1980 (*Mason*) (TC); 3 ♀, same locality, ii.1984 (*Cameron*) (WC); 1 ♂, 2 ♀, same locality, i-iii.1986 (*Haber*) (BMNH); 2 ♀, same locality, i-ii.1986 (*Forsyth*) (CNC): San José Prov.: 4 ♀, San Antonio de Escazú, 1300 m, v-vi.1981 (*Eberhard*) (UMC); 1 ♂, same locality, iii.1984 (*Cameron*) (WC). Cuba: 1 ♂, Cayamas (*Schwartz*) (USNM); 1 ♂, 3 ♀, Soledad, nr Cienfuegas viii.1926 (*Banks & Bequaert*) (MCZ); 1 ♂, 1 ♀, same locality vii.1925 (*Myers*) (MCZ); 1 ♀, same locality, i-ii.1927 (*Brues*) (MCZ); 1 ♀, Soledad, Santa Clara, vi.1939 (*Parsons*) (MCZ). **Ecuador**: 1 ♀, Cumbaratza, iv.1965 (*Peña*) (TC); 1 ♀, Santa Isabel (W), v.1965 (*Peña*) (TC). **Jamaica**: 1 ♀, Mandeville, x.1970 (*Frank*) (BMNH); 1 ♀, Trelawney, Baron Hill (*Perkins*) (MCZ). **Mexico**: Chiapas: 1 ♀, 32 km N. Huixtla, 1000 m, vi.1969 (*Mason*) (CNC); 1 ♀, L. Montebello National Park, 1700 m, v.1969 (*Mason*) (CNC). **Panama**: 1 ♂, Cerro Campana, nr Chica iv.1985 (*Duckworth*) (USNM); 1 ♂, Chiriqui, Alto Lino, 1300 m, vi.1965 (*Real*) (CAS). **U.S.A.**: Alabama: 1 ♀, Opelika, vii.01 (*Greene*) (USNM): Florida: 43 ♂, 56 ♀, from the following counties- Alachua, Charlotte, Dade, Gadsden, Highlands, Lake, Manatee, Monroe, Pinellas, Polk, all months (CAS; CNC; FSCA; TC; USNM). **Venezuela**: 1 ♂, San Esteban, ix.1910 (USNM).

Enicospilus carlota sp. n.

(Fig. 256)

Description. Mandibles moderately long, evenly tapered, apically twisted about 45°; upper mandibular tooth slightly compressed, 1.6 times as long as the lower tooth; outer mandibular surface sparsely pubescent, with a strong basal concavity. Labrum 0.4 times as long as broad; malar space 0.3 times as long as basal mandibular width. Clypeus in profile weakly convex, margin blunt; clypeus in front view 1.25 times as broad as long, its apical margin truncate. Lower face 0.64 times as broad as long, rather smooth. Head in dorsal view with genae constricted behind eyes; posterior ocellus contiguous with eye; FI = 65%; occipital carina mediodorsally complete, ventrally curved to join hypostomal carina about 0.7 times the basal mandibular width away from mandible. Antenna long and slender, with 57 flagellar segments; 20th segment 2.5 times as long as broad.

Mesoscutum very weakly polished, sparsely punctate, in profile evenly rounded; notauli vestigial. Mesopleuron weakly polished, the upper part posterodorsally longitudinally wrinkled and centrally smooth, the lower part irregularly wrinkled; epicnemial carina inclined towards anterior margin of pleuron. Scutellum in profile moderately convex, laterally carinate for all of its length; scutellum in dorsal view 1.3 times as long as anteriorly broad, smooth and polished. Metapleuron quite strongly convex, with weak irregular diagonal wrinkling; submetapleural carina barely broadened anteriorly; posterior transverse carina of mesosternum complete. Propodeum in profile evenly rounded; anterior transverse carina complete, posterior transverse carina absent; anterior area quite steep, strongly wrinkled; spiracular area moderately long, smooth; posterior area wrinkled-reticulate; lateral longitudinal carina complete, strong, not joined to spiracular margin by a short carina.

Fore wing length 13 mm; discosubmarginal cell as in Fig. 256; AI = 1.47; CI = 0.70; ICI = 0.35; SDI = 1.25; *cu-a* distal to the base of *Rs&M* by 0.6 times its own length; marginal cell proximally glabrous; 1st subdiscal cell with distal part centrally sparsely hirsute; 2nd subdiscal cell unusual in having a glabrous arc from *Cu*1b to *Cu*1a; vein *Cu*1b exceptional in bearing several very long fine hairs. Hind wing with 6 hamuli on *R*1; 1st abscissa of *Rs* long, weakly bowed, 2nd abscissa slightly curved.

Fore leg with tibia weakly flattened, with fine, scattered spines on outer surface. Mid leg with longer tibial spur 1.4 times length of the shorter. Hind leg with coxa in profile 1.8 times as long as deep; trochantellus dorsally 0.2 times as long as broad; 4th segment of tarsus 2.6 times as long as broad; claws of female long, with short pectinae.

Gaster long and slender; tergite 2 in profile 5.5 times as long as posteriorly deep, laterotergite pendant but narrow, thyridia elliptical and separated from anterior margin of tergite by about 2 times its own length. Ovipositor concealed, its sheath narrow. Male unknown.

Colour generally yellow, but with most of mesoscutum, part of mesopleuron, metanotum and propodeum dorsally dark reddish brown; legs and gaster golden; interocellar area black; antenna golden; pterostigma golden; wings hyaline.

VARIATION. Only a single individual is known.

REMARKS. The pendant laterotergite 2 and the long labrum suggest *E. carlota* belongs to the *trilineatus* species-group. It differs from most other species in this complex in possessing a glabrous arc in the 2nd subdiscal cell of the fore wing, in having *cu-a* distal to the base of *Rs&M*, in possessing very long fine hairs on *Cu*1b and in having an exceptionally large CI. One other species, *E. dajaboni*, shares these specialized features and the two are clearly a sister-species pair. Whilst *E. dajaboni* is only known from the island of Hispaniola, *E. carlota* is apparently restricted to Cuba. *E. carlota* differs from *E. dajaboni* in possessing a central sclerite, lacking a distal sclerite and having the alar hairs far more sparsely distributed. They also differ strikingly in colour pattern.

BIOLOGICAL INFORMATION. *Enicospilus carlota* is only known to occur on the island of Cuba. Nothing is known of its biology.

MATERIAL EXAMINED

Holotype ♀, **Cuba**: Trinidad Mts, Mina Carlota, v.1925 (*Salt*) (USNM).

Enicospilus dajaboni sp. n.

(Fig. 257)

DESCRIPTION. Mandibles moderately long, evenly tapered, apically twisted 10°; upper mandibular tooth subcylindrical, 1.4 times as long as the lower tooth; outer mandibular surface sparsely pubescent, more or less flat. Labrum 0.45 times as long as broad; malar space 0.4 times as long as basal mandibular width. Clypeus in profile out-flared, margin blunt; clypeus in front view 1.45 times as broad as long, with margin apically weakly convex. Lower face 0.73 times as broad as long, polished, with a particularly strongly developed median ridge. Head in dorsal view with genae strongly constricted behind the eyes; posterior ocellus close to eye; FI = 75%; occipital carina mediodorsally complete, convex, ventrally curved to join hypostomal carina about 0.9 times the basal mandibular width away from mandible. Antenna slender, with 57 flagellar segments; 20th segment 2.4 times as long as broad.

Mesoscutum polished, with fine indistinct punctures, in profile abruptly rounded; notauli absent. Mesopleuron highly polished, the upper part smooth, the lower part striate; epicnemial carina strong, curved towards anterior margin of pleuron. Scutellum in profile moderately convex, laterally carinate for all of its length; scutellum in dorsal view 1.5 times as long as anteriorly broad, smooth, posteriorly wrinkled. Metapleuron convex, weakly wrinkled; submetapleural carina weakly anteriorly broadened; posterior transverse carina of mesosternum complete. Propodeum in profile evenly declivous; anterior transverse carina complete, posterior transverse carina absent; anterior area moderately long, striate; spiracular area moderately long, smooth; posterior area concentrically wrinkled; lateral longitudinal carina extending behind anterior transverse carina, joined to spiracular margin by a weak short carina.

Fore wing length 11 mm; discosubmarginal cell as in Fig. 257; AI = 1.75; CI = 0.88; ICI = 0.25; SDI = 1.31; *cu-a* distal to the base of *Rs&M* by 0.3 times its own length, rather oblique; marginal cell sparsely pubescent; 1st subdiscal cell with distal 0.5 hirsute; 2nd subdiscal cell with a pronounced glabrous arc extending from near base of *Cu*1b and paralleling *Cu*1a; *Cu*1b exceptional in bearing scattered long hairs. Hind wing with 5 hamuli on *R*1; 1st and 2nd abscissae of *Rs* weakly bowed; hind wing exceptional in that *cu-a* is virtually obliterated and distal abscissa of *Cu*1 arises from very close to 1*A*.

Fore leg with tibia weakly flattened, with scattered spines on outer surface. Mid leg with longer tibial spur 1.3 times length of the shorter. Hind leg with coxa in profile 1.9 times as long as deep; trochantellus dorsally 0.2 times as long as broad; 4th segment of tarsus 2.8 times as long as broad; hind tarsal claws of male short, strongly geniculate, with short pectinae.

Gaster long and slender; tergite 2 in profile more than 6 times as long as posteriorly deep, laterotergite pendant, thyridia elliptical and separated from anterior margin of tergite by about 4 times its own length. Female unknown. Male with sternites 7–9 bearing long fine semierect pubescence; gonosquama distally rounded, dorsally slightly excavate.

Colour generally pale brownish yellow, with face, orbits upper part and lower posterior corner of mesopleuron, scutellum, metanotum laterally and metapleuron partly whitish yellow; interocellar area black; antenna yellowish, distally infuscate; pterostigma yellowish brown; wings hyaline.

REMARKS. *Enicospilus dajaboni* belongs to the *trilineatus* species-group. It is rather similar to *E. carlota*. Both of these species have *cu-a* positioned well distal to the base of *Rs&M*, a large CI, long hairs on *Cu*1b and a glabrous arc in the 2nd subdiscal cell (see discussion of *E. carlota*).

BIOLOGICAL INFORMATION. *Enicospilus dajaboni* is only known to occur on the island of Hispaniola in the Caribbean. Nothing is known about its biology.

MATERIAL EXAMINED

Holotype ♂, **Dominican Republic**: Dajabon Prov., 13 km S. of Loma de Cabrera, 400 m, v.1973 (*Davis*) (USNM).

Enicospilus porteri sp. n.

(Figs 103, 258)

DESCRIPTION. Mandibles moderately long, evenly tapered, apically twisted 15–25°; upper mandibular tooth slender, slightly compressed, 1.7–1.8 times as long as the lower tooth; outer mandibular surface sparsely pubescent, flat, but with a strongly developed proximal concavity. Labrum granulate, matt, 0.4 times as long as broad; malar space 0.5 times as long as basal mandibular width. Clypeus in profile strongly convex, margin blunt; clypeus in front view 1.1–1.3 times as broad as long, the apical margin weakly convex. Lower face 0.60–0.65 times as broad as long, polished, sparsely punctate. Head in dorsal view with genae evenly rounded; posterior ocellus close to eye; FI = 60–65%; occipital carina mediodorsally strong, ventrally curved to join strongly raised hypostomal carina about 0.9 times the basal mandibular width away from mandible. Antenna long and slender, with 62–64 flagellar segments; 20th segment 3.0–3.5 times as long as broad.

Mesoscutum polished, punctate, in profile evenly rounded; notauli vestigial. Mesopleuron polished, the upper part finely and sparsely punctate, ventrally grading to coarsely wrinkled/rugose; epicnemial carina strong, curved weakly towards anterior margin of pleuron. Scutellum in profile weakly convex, laterally carinate for all of its length; scutellum in dorsal view 1.7–1.8 times as long as anteriorly broad, polished, smooth. Metapleuron convex, posterodorsally rugose, grading to smooth and finely punctate ventrally (Fig. 103); submetapleural carina weakly anteriorly broadened; posterior transverse carina of mesosternum complete. Propodeum in profile evenly declivous; anterior transverse carina complete, posterior transverse carina absent; anterior area striate, spiracular area smooth, posterior area reticulate; lateral longitudinal carina more or less complete, joined to spiracular margin by a short carina.

Fore wing length 14–15 mm; discosubmarginal cell as in Fig. 258; AI = 0.95–1.14; CI = 0.22–0.27; ICI = 0.38–0.42; SDI = 1.05–1.20; *cu-a* proximal to the base of *Rs&M* by 0.2–0.3 times its own length; marginal cell proximally evenly hirsute; 1st subdiscal cell with anterior and distal parts sparsely hirsute. Hind wing with 7 hamuli on *R*1; 1st abscissa of *Rs* straight, 2nd abscissa straight.

Fore leg with tibia subcylindrical, with scattered spines on outer surface. Mid leg with longer tibial spur 1.3 times length of the shorter. Hind leg with coxa in profile 1.8–1.9 times as long as deep; trochantellus dorsally 0.2 times as long as broad; 4th segment of tarsus 2.6–2.7 times as long as broad; claws of male with short, close, inwardly angled pectinae.

Gaster long and slender; tergite 2 in profile about 6 times as long as posteriorly deep, laterotergite pendant, thyridia elliptical and separated from anterior margin of tergite by 4–5 times its own length. Female unknown. Males with sternites 7–9 bearing dense, long, semidecumbent pubescence; gonosquama long, obliquely truncate; male subgenital plate simple.

Colour generally orange, face, genae and alitrunk irregularly laterally pale-marked; gaster with terminal segments blackish; interocellar area blackish; antenna dark brown, scape paler; pterostigma brown; wings more or less hyaline.

VARIATION. *Enicospilus porteri* is morphologically and chromatically a rather uniform species, though the intensity of the dark colour at the posterior end of the gaster varies from brownish black to black.

REMARKS. This species is named in honour of Dr Charles Porter, in recognition of his outstanding work on the Neotropical Ichneumonidae.

The pendant laterotergite 2 and the long labrum suggest that *E. porteri* belongs to the *trilineatus* species-group. Unlike many other taxa in this group, *E. porteri* does not have a specialized aedeagus, or a pointed subgenital plate. It most closely resembles *E. dirzoi*, but differs in having more elongate antennae, coarser thoracic sculpture and quite different alar sclerites.

BIOLOGICAL INFORMATION. *Enicospilus porteri* is only known to occur in wet forests in Costa Rica, where individuals have been collected at altitudes between 750 and about 1000 m. Its host is unknown.

MATERIAL EXAMINED

Holotype ♂, **Costa Rica**: Alajuela Prov., Finca Campana, 5 km NW. Dos Ríos, 750 m, i.1986 (*Janzen & Hallwachs*) (BMNH).

Paratypes. **Costa Rica**: Cartago Prov.: 2 ♂, IICA Turrialba, viii.1963 (*Porter*) (MCZ).

Enicospilus lupemejia sp. n.

(Fig. 259)

DESCRIPTION. Mandibles moderately long, rather evenly and weakly tapered, apically twisted 15–25°; upper mandibular tooth slightly compressed, 1.2–1.4 times as long as the lower tooth; outer mandibular surface smooth, weakly concave, with a well-developed proximal concavity. Labrum 0.4–0.5 times as long as broad; malar space 0.5 times as long as basal mandibular width. Clypeus in profile strongly convex near apex, margin impressed; clypeus in front view 1.1–1.3 times as broad as long, the apical margin truncate. Lower face 0.68–0.71 times as broad as long, polished, sparsely and finely punctate. Head in dorsal view with genae quite long, evenly narrowed behind eyes; posterior ocellus very close to eye; FI = 60–65%; occipital carina mediodorsally complete, ventrally curved to join hypostomal carina about 1.0 times the basal mandibular width away from mandible. Antenna long and slender, with 55–58 flagellar segments; 20th segment 2.7–3.0 times as long as broad.

Mesoscutum polished, finely punctate, in profile evenly rounded; notauli vestigial. Mesopleuron polished, the upper part finely punctate, the lower part with a band of coarse striate sculpture extending from epicnemial carina to lower hind corner; epicnemial carina strong, curved towards anterior margin of pleuron. Scutellum in profile weakly convex, laterally carinate for 0.8 or more of its length; scutellum in dorsal view 1.4–1.6 times as long as anteriorly broad, smooth and polished, but with posterior part usually longitudinally striate. Metapleuron weakly convex, coriaceous, with upper part rugose reticulate; submetapleural carina evenly anteriorly broadened; posterior transverse carina of mesosternum complete. Propodeum in profile evenly declivous; anterior transverse carina complete except at lateral ends; posterior transverse carina absent; anterior area long, striate; spiracular area moderately long, smooth; posterior area reticulate; lateral longitudinal carina present anteriorly, not joined to spiracular margin by a short carina.

Fore wing length 12–14 mm; discosubmarginal cell as in Fig. 259; AI = 1.31–1.75; CI = 0.26–0.43; ICI = 0.33–0.38; SDI = 0.97–1.21; *cu-a* opposite to the base of *Rs&M*; marginal cell proximally with a small glabrous or less hirsute area adjacent to *Rs+2r*; 1st subdiscal cell with antero-distal part hirsute. Hind wing with 5–7 hamuli on *R*1; 1st abscissa of *Rs* straight, 2nd abscissa straight.

Fore leg with tibia slightly flattened, with isolated fine spines on outer surface. Mid leg with longer tibial spur 1.5–1.7 times length of the shorter. Hind leg with coxa in profile 1.7–1.8 times as long as deep; trochantellus dorsally 0.3–0.4 times as long as broad; 4th segment of tarsus 2.6–3.1 times as long as broad; claws of female rather short, apically abruptly curved, sparsely pectinate; claws of male similar.

Gaster slender; tergite 2 in profile 6 times as long as posteriorly deep, laterotergite membranous, narrow, pendant; thyridia elliptical and separated from anterior margin of tergite by about 3 times its own length. Ovipositor slender, its sheath narrow. Male with sternites 7–9 bearing fine decumbent pubescence; gonosquama apically rounded; aedaegus partly concealed, but apparently without a flange.

Colour generally yellowish orange, with face, orbits, mesoscutal stripes, scutellum and upper part of mesopleuron brighter yellow; occiput often infuscate; interocellar area, mesoscutum extensively, upper hind margin of mesopleuron, epicnemium, axillae, mesosternum and often also an anterior mark on the metapleuron black; gaster orange with tergites 5+ infuscate or black; antenna generally orange, distally infuscate; pterostigma yellowish brown; wings hyaline.

VARIATION. The female from Ecuador is slightly less extensively dark-marked than the Central American species.

REMARKS. This species is named in honour of Lupe Mejia for her pioneer spirit in the maintenance of the Mengo Biological Station.

Enicospilus lupemejia may easily be recognized by its characteristic colour pattern, and by the anteriorly strongly acute proximal sclerite in the fore wing. The pendant membranous laterotergite and large labrum indicate that this species belongs to the *E. trilineatus* species-group. Structurally it is very similar to *E. trilineatus* from which it can be separated by the characters given in the key. The male of *lupemejia* has the posterior margin of the subgenital plate simply convex, lacking the small median tubercle characteristic of *trilineatus*.

BIOLOGICAL INFORMATION. *Enicospilus lupemejia* is a widely distributed but rarely collected species whose range extends from Oaxaca in southern Mexico south to Ecuador. In Costa Rica it is associated with partially forested areas at altitudes between 800 and 1350 m. Its host is unknown.

MATERIAL EXAMINED

Holotype ♀, **Costa Rica**: Guanacaste Prov., Finca La Luz (Estacion Mengo) on SW. side of Volcán Cacao, 1100 m, i.1987 (*Janzen & Hallwachs*) (BMNH).

Paratypes. **Costa Rica**: Alajuela Prov.: 1 ♂, San Ramón Reserve, Río San Lorencito, 800 m, iii.1987 (*Chacon*) (BMNH): Puntarenas Prov.: 1 ♀, Monteverde, 1350 m, i.1986 (*Haber*) (BMNH): San José Prov.: 1 ♂, San Antonio de Escazú, iii-iv.1984 (*Cameron*) (WC). **Ecuador**: 1 ♀, Los Ríos, Río Palenque, vi.1974 (*Longino*) (FSCA). **Mexico**: Oaxaca: 1 ♂, Metate, 85.5 km SW. Tuxtepec, 900 m, x.1962 (*Townes*) (TC).

Enicospilus trilineatus (Brullé)

(Figs 100, 174, 175, 260)

[*Ophion flavus* (Fabricius); Guérin-Méneville & Percheron, 1835: liv. 7, pl. 3. Misidentification.]
Ophion trilineatus Brullé, 1846: 140. Lectotype ♀, BRAZIL (MNHN), designated by Townes & Townes (1966: 183) [examined].
Ophion striatus Brullé, 1846: 142. Holotype ♀, BRAZIL (MNHN) [examined]. [Synonymized by Townes & Townes, 1966: 183.]
Ophion sphacelatus Erichson, 1848: 587. Lectotype ♀, GUYANA (MNHU), designated by Townes & Townes (1966: 183). [Synonymized by Townes & Townes, 1966: 183.]
Ophion nigricauda Taschenberg, 1875: 437. Lectotype ♀, BRAZIL (FZLU), designated by Townes & Townes (1966: 183). [Synonymized by Townes & Townes, 1966: 183.]
[*Ophion (Enicospilus) flavus* (Fabricius); Cameron, 1886: 292. Misidentification.]
Ophion (Enicospilus) vecors Tosquinet, 1896: 387. Holotype ♂, type locality unknown (MNHU). [Synonymized by Townes & Townes, 1973: 377.]
Ophion (Eniscospilus)(sic) *appendiculatum* Felt, 1902: 308. Syntypes, U.S.A. (NYSM, Albany). **Syn. n.**
Enicospilus appendiculatus (Felt) Felt, 1904: 76.
Henicospilus appendiculatus (Felt) Szépligeti, 1905: 27.
Henicospilus trilineatus (Brullé) Szépligeti, 1905: 27.
Henicospilus striatus (Brullé) Szépligeti, 1905: 27.
Henicospilus nigricauda (Taschenberg) Szépligeti, 1905: 27.
Henicospilus brasiliensis Szépligeti, 1906: 147. Holotype ♀, BRAZIL (TM). [Synonymized by Townes & Townes, 1966: 183.]
Enicospilus maculiceps Cameron, 1911: 180. Holotype ♀, GUYANA (BMNH) [examined]. [Synonymized by Townes & Townes, 1966: 184.]
Enicospilus nigricauda (Taschenberg) Hooker, 1912: 65.
Enicospilus brullei Hooker, 1912: 70. [Unnecessary replacement name for *striatus* Brullé.]
Enicospilus trilineatus (Brullé) Hooker, 1912: 71.
[*Enicospilus flavus* (Fabricius); Hooker, 1912: 71, in part. Misidentification.]
Enicospilus sphacelatus (Erichson) Hooker, 1912: 79.

Enicospilus brasiliensis (Szépligeti) Hooker, 1912: 86.
[*Henicospilus purgatus* (Say); Morley, 1912: 33. Misidentification.]
Henicospilus brevinervis Morley, 1912: 34. Holotype ♀, ST. VINCENT (BMNH) [examined]. **Syn. n.**
Henicospilus nigricauda var. *brasiliensis* Szépligeti; Enderlein, 1921: 36.
[*Enicospilus flavus* (Fabricius); Cushman, 1947: 481. Misidentification.]
Enicospilus appendiculatus (Felt); Townes & Townes, 1966: 174.
Enicospilus trilineatus (Brullé); Townes & Townes, 1966: 183.
Enicospilus trilineatus (Brullé); Gauld & Carter, 1983: 148.

DESCRIPTION. Mandibles moderately long, weakly and evenly narrowed, apically twisted 10–35°; upper mandibular tooth cylindrical or slightly compressed, 1.2–1.7 times as long as the lower tooth; outer mandibular surface flat with a weak to moderately strong proximal concavity. Labrum 0.4–0.5 times as long as broad (Fig. 174); malar space 0.4–0.6 times as long as basal mandibular width. Clypeus in profile weakly convex, margin blunt; clypeus in front view 1.1–1.4 times as broad as long, the apical margin weakly convex. Lower face 0.60–0.70 times as broad as long, polished with fine sparse punctures centrally. Head in dorsal view with genae weakly constricted; posterior ocellus contiguous with eye; FI = 60–77% ; occipital carina mediodorsally complete, ventrally curved to join hypostomal carina about 0.7–1.0 times the basal mandibular width away from mandible. Antenna moderately slender, with 50–60 flagellar segments; 20th segment 2.2–2.7 times as long as broad.

Mesoscutum polished, finely punctate, in profile evenly rounded; notauli vestigial. Mesopleuron polished, the upper part sparsely punctate, the lower part punctostriate to striate; epicnemial carina curved towards anterior margin of pleuron. Scutellum in profile weakly convex, laterally carinate for at least 0.5 of its length, generally more; scutellum in dorsal view 1.5–1.7 times as long as anteriorly broad, punctate to punctocoriaceous, posteriorly often wrinkled. Metapleuron generally moderately convex, punctate, punctostriate or coriaceous; submetapleural carina weakly and evenly broadened anteriorly; posterior transverse carina of mesosternum complete. Propodeum in profile evenly declivous; anterior transverse carina from present centrally to complete, posterior transverse carina absent; anterior area striate; spiracular area almost smooth or punctate; posterior area reticulate wrinkled; lateral longitudinal carina present at least anteriorly, often complete, usually not joined to spiracular margin by a short carina.

Fore wing length 10–18 mm; discosubmarginal cell as in Fig. 260; AI = 0.66–1.38; CI = 0.32–0.55; ICI = 0.33–0.49; SDI = 1.05–1.30; *cu-a* from slightly proximal to, to slightly distal to the base of $Rs+M$; marginal cell from uniformly hirsute to somewhat glabrous proximally; 1st subdiscal cell with scattered pubescence. Hind wing with 5–9 hamuli on $R1$; 1st abscissa of Rs straight, 2nd abscissa weakly curved to almost straight.

Fore leg with tibia subcylindrical, with scattered spines on outer surface. Mid leg with longer tibial spur 1.2–1.4 times length of the shorter. Hind leg with coxa in profile 1.7–2.0 times as long as deep; trochantellus dorsally 0.1–0.3 times as long as broad; 4th segment of tarsus 2.5–3.1 times as long as broad; claws of female moderately long, apically abruptly curved, with long rather stout pectinae, those of male very similar.

Gaster slender; tergite 2 in profile at least 4.5 times as long as posteriorly deep, laterotergite narrow, membranous, pendant (Fig. 100); thyridia oval to elliptical and separated from anterior margin of tergite by about 4–5 times its own length. Ovipositor slender, its sheath narrow. Males with sternites 7–9 bearing fine decumbent pubescence; subgenital plate with posterior margin produced medially to form a weak point; gonosquama quite stout, dorsally notched; aedeagus slender with a strong basal crest (Fig. 175).

Colour generally orange, usually with the terminal segments of the gaster black; interocellar area black; antenna reddish orange; pterostigma orange; wings hyaline.

VARIATION. *Enicospilus trilineatus* is morphologically and chromatically an extremely variable species and a number of more or less characteristic morphotypes occur in different areas.

The North American and northern Mexican specimens generally have the gaster more or less uniformly yellowish brown, though often the terminal segments are very slightly darker than the anterior ones. The male subgenital plate bears a strong median tooth, the central sclerite is usually small and weak, the metapleuron is very closely and coarsely punctate, the antennae are brownish yellow and *cu-a* is virtually opposite the base of $Rs+M$. Rather similar individuals occur in Jamaica, the Dominican Republic and the Lesser Antilles. Some individuals have the interocellar area yellow, and the most extreme examples have large pale marks on the alitrunk; this colour pattern has been observed in specimens from coastal habitats, such as in the Bahamas. The North American and Mexican examples of the pale morph have previously been called *E. appendiculatus* (Felt) (e.g. in Carlson, 1979) whilst the West Indian individuals were described as a separate species, *brevinervis*, by Morley (1912). The Galapagos population is very similar, but specimens from these islands have slightly stouter antennae (Gauld & Carter, 1983).

This pale morph grades, in the southern part of its range, into a structurally rather similar form that has the terminal segments of the gaster black (the true *trilineatus* of Brullé, 1846). This is the usual form encountered in lowland Central America from Mexico and Belize south to Argentina. In Costa Rica it is also the form encountered in suburban habitats at moderate elevations, such as in San Antonio de Escazú (1300 m). It is also the usual form encountered in Trinidad. This form shows considerable variation in the extent of pigmentation of the central sclerite, and the metapleuron is often less coarsely sculptured than the pale form. At moderate altitude (700–2000 m), humid forest sites in southern Central America (e.g. Monteverde and Braulio Carrillo National Park, Costa Rica) and with a range extending southwards at similar altitude to Peru is a third morph. This morph is characterized by being darker than either of the preceding two. Females generally have all the gastral tergites from 3+ blackish, and males have tergites 4+ black. The majority of examples of this morph have the flagellum distal to segment 1 infuscate, but some individuals have the antennae brownish orange. Frequently the metapleural sculpture tends to striate. The subgenital plate of some males has only a weakly developed median apical tooth. Several individuals have irregular pale yellow markings on the pro-, meso- and metathorax, and a few have a dark mark on the median lobe of the mesoscutum.

Almost all specimens of the pale, black-marked and dark morphs have a weakly to moderately developed central sclerite and a characteristic appendiculate proximal sclerite. However, there is in Mesoamerican cloud forests (such as at Monteverde, Costa Rica or Fortuna, Panama) a fourth morph which is characterized by having a more or less regularly triangular proximal sclerite and no distinct trace of the central sclerite. This morph is often darker orange-brown than many examples of other morphs, and individuals usually have profuse pale markings on the alitrunk. The two males of this morph that I have examined have no distinguishable median apical tooth on the subgenital plate, yet they have the characteristic flanged aedeagus that is typical of all members of this species. A Brazilian/Ecuadorian species, *E. hookeri*, is rather similar to this, but has a trace of a central sclerite discernible. For the present *E. hookeri* has not been included as a synonym pending further investigation of its status.

REMARKS. It is not easy to decide what status to accord all of the morphotypes described above, but here I suggest they all be regarded as a single species. The reasons for advocating this course of action can be summarized as follows. Firstly, although the morphs characterized are generally separable, individuals exist which can only arbitrarily be assigned to one or the other of the morphs. For example, an almost complete spectrum of variation exists from individuals with uniformly orange gasters (the pale morph) to those with tergites 3+ black (the dark morph). Generally speaking, species in more humid areas are darker marked, and this type of variation is encountered in other species in other regions (e.g. *E. ramidulus* in the Palaearctic). Secondly, within a morph there is often a rather similar range of variation of, for example, the form of the metapleural sculpture. Thirdly, in the case of the triangular sclerite morph, the distinctive sclerite only really represents the most extreme form of a great range of variation, and one cannot actually characterize the shape of the sclerite found in other forms, except to say that it is not regularly triangular. Similarly, although no individuals of the triangular morph have a central sclerite, I have seen individuals of other morphs which also lack a central sclerite; I have found considerable variation in this feature in a single population in Santa Rosa National Park, Costa Rica. Finally, extensive variation of the type outlined above is not uncommon in species of *Enicospilus* that are frequently encountered in disturbed or agricultural habitats. The considerable variation in size alone clearly suggests that this species is attacking a range of different sized hosts, and I do not find it surprising that individuals of a single species developing on different hosts in ephemeral habitats under different regimes of temperature and humidity, differ slightly in colour and structure (see also p. 6)

Enicospilus trilineatus was misidentified as *Enicospilus flavus* by Guérin-Méněville & Percheron (1835) and by Cameron (1886). The excellent figure in Cameron's work may have caused this misidentification to be perpetuated. Clearly the figure of *E. flavus* in Cushman (1947) is *E. trilineatus* and all references in the literature to *flavus* between 1835 and 1947 may be misidentifications of *trilineatus*.

Ophion (*Enicospilus*) *vecors* was described from a specimen allegedly collected in South Africa (Tosquinet, 1896). Townes & Townes (1973) state that this type locality is incorrect as this is a Neotropical species, and I concur. Although I examined many thousands of specimens while revising Afrotropical *Enicospilus* (Gauld & Mitchell, 1978), I have never seen another specimen of this species from Africa. Morley's (1912) records of *vecors* as African are based on misidentifications of *E. dubius* (Tosquinet).

Enicospilus trilineatus together with *E. hookeri*, *E. dajaboni* and *E. carlota* form a natural species group characterized by the following apomorphic features:

(a) laterotergite of tergite 2 pendant;
(b) aedeagus with a pronounced crest;
(c) labrum at least 0.4 times as long as basally broad.

The Mesoamerican species *E. lupemejia*, *E. dirzoi* and *E. porteri* also share apomorphies a) and c) and undoubtedly belong to this species-group also, though they differ from the other members of the group in having a simple aedeagus. Furthermore, in *E. dirzoi* the laterotergite is generally only pendant anteriorly.

The *trilineatus* species-group is endemic to the New World. It is possible that *E. dirzoi* is closely related to, or is actually the stem-species from which the *trilineatus* group is derived. Within the group, the species pair *E. dajaboni* and *E. carlota* form a distinctive subgroup characterized by several apomorphic features including the possession of a group of long hairs on vein *Cu*1b, and having a well-defined glabrous arc in the 2nd subdiscal cell of the fore wing (see discussion of *carlota*). *E. trilineatus* and *E. hookeri* are less specialized. *Enicospilus trilineatus* may be recognized by having a gonosquama that is a little stouter than that of other taxa, and the median point on the subgenital plate is not found in other species in this group. It is the only species (apart from *hookeri* which occurs further south and may not warrant specific distinction anyway) with a characteristic 'appendiculate' proximal sclerite (Fig. 260).

BIOLOGICAL INFORMATION. *Enicospilus trilineatus* is widely distributed (Map 17) from the United States (where it has been collected from Florida north to the Carolinas and west to Alabama) through the Caribbean states and Central America (north to southern Texas), south to Paraguay and Argentina. It also occurs on the Galapagos Islands (Gauld & Carter, 1983).

In Costa Rica *E. trilineatus* is widely distributed and specimens are usually collected whenever light-trapping is undertaken. I have seen specimens from Finca Campana, Finca San Gabriel, La Fortuna, Vara Blanca and Virgen de Socorro in Alajuela Province; Casa Mata and Turrialba in Cartago Province; Cerro el Hacha, Finca La Luz (= Estacion Mengo) on Volcán Cacao, Rincón de la Vieja and Santa Rosa National Parks in Guanacaste Province; Tortuguero National Park in Limón Province; Corcovado National Park, Esparta, Fila Esquinas, Finca Las Cruces (6 km S. of San Vito de Java), Manuel Antonio National Park and Monteverde in Puntarenas Province; Braulio Carrillo National Park and San Antonio de Escazú in San José Province. At Santa Rosa National Park in lowland (300 m) seasonally dry forest *E. trilineatus* is rather an uncommon species and the cumulative seasonal data for 1981–6 are:

J	F	M	A	M	J	J	A	S	O	N	D
2	1	2	–	4	6	–	–	–	1	2	–

Most Santa Rosan individuals belong to the black-marked morph though isolated specimens were entirely pale. None belonged to the triangular or dark morphs.

In the mosaic of wet forest and dairy farmland at Monteverde (1350 m) all morphs have been collected, but about 90 % of the individuals belong to the dark morph. At this site *E. trilineatus* seems to be most common at the beginning of the year. The cumulative seasonal data for 1984–6 are:

J	F	M	A	M	J	J	A	S	O	N	D
6	9	3	2	5	2	2	2	–	–	–	1

In humid forest in Braulio Carrillo National Park isolated individuals have been collected in January, March, July and October. Most of these specimens are the dark morph though an isolated individual of the triangular morph has also been taken at this site. No individuals of the pale or black-marked morphs have been collected at Braulio Carrillo.

In Panama, on Barro Colorado Island, virtually all individuals belong to the black-marked morph, though isolated specimens of the pale morph have been taken. The cumulative seasonal distributional data for 1983–5 are:

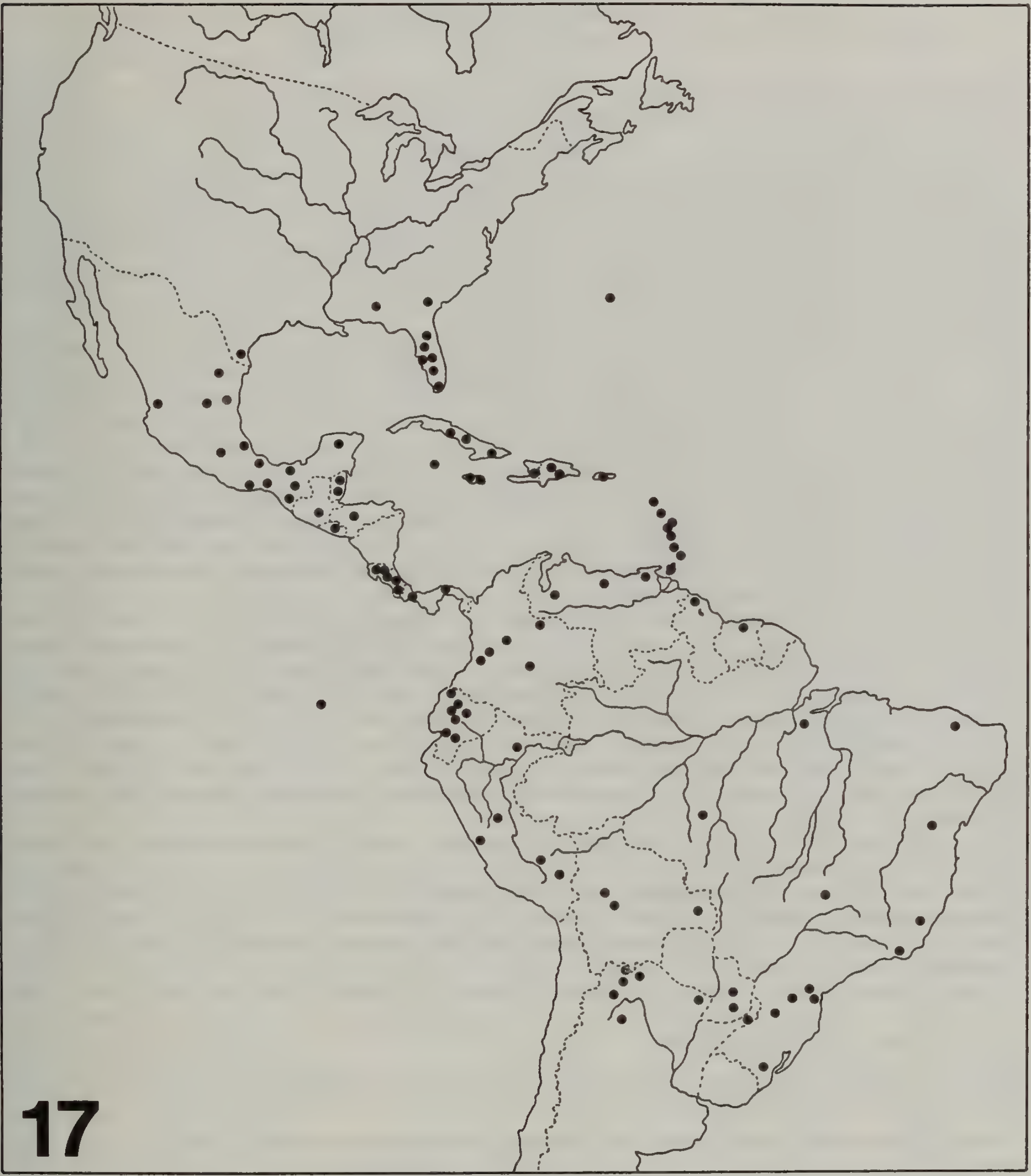
J	F	M	A	M	J	J	A	S	O	N	D
–	–	–	1	1	–	1	5	2	4	–	1

Despite the fact that *E. trilineatus* is one of the most common and widely distributed species in the genus I have seen no reared material. Bodkin (1918) recorded it from *Amyna octo* (Guenée) (Lepidoptera: Noctuidae) in Guyana, but I have not seen the material on which this record is based.

MATERIAL EXAMINED

Lectotype ♀ (*Ophion trilineatus* Brullé), **Brazil**: Rio de Janiero (MNHN). Holotype ♀ (*Ophion striatus* Brullé), **Brazil**: Rio de Janeiro (MNHN). Holotype ♀ (*Enicospilus maculiceps* Cameron), **Guyana** (BMNH). Holotype ♀ (*Henicospilus brevinervis* Morley), **Saint Vincent**: vi.1835 (*Walker*) (BMNH). Homotypes (compared with primary types by Dr H. Townes) of other species have also been examined.

189 ♂, 213 ♀, from **Argentina** (Formosa, Jujuy, Misiones, Salta, Tucumán); **Bahamas** (Eleuthera); **Balthazar; Barbados; Belize; Bermuda; Bolivia** (Beni, Cochabamba, Santa Cruz, Yungas); **Brazil** (Bahia,



Map 17 Localities at which *Enicospilus trilineatus* has been collected.

Bonito, Ceara, Espiritu Santo, Mato Grosso, Minas Gerais, Pará, Paraná, Río Grande do Sul, Rio de Janeiro, Santa Catarina, São Paulo); **Colombia** (Arauca, Caqueta, Cundinamarca, Meta, Valle); **Costa Rica** (Alajuela, Cartago, Guanacaste, Puntarenas, San José) **Cuba;** Dominica; Dominican Republic; **Ecuador** (Esmeraldas, Galapagos Is., Napo, Pastaza, Pichincha); **El Salvador; Guadeloupe; Guatemala; Grand Cayman; Grenada; Guyana; Haiti; Honduras; Jamaica; Martinique; Mexico** (Chiapas, Guerrero, Morelos, Nuevo León, Oaxaca, San Luis Potosí, Sinaloa, Tabasco, Tamaulipas, Veracruz, Yucatan); **Montserrat; Panama** (Canal Zone, Chiriqui); **Paraguay; Peru** (Chanchamayo, Cuzco, Huanuco, Lima, Loreto, Tinggo Maria) **Puerto Rico; Saint Lucia; Saint Vincent; Surinam; Tobago Trinidad; U.S.A.** (Alabama, Florida, South Carolina, Texas); **Venezuela** (Aragua, Merida, Sucre). (BMNH, CAS, CNC, MCZ, TC, UM, USNM.)

Enicospilus dirzoi sp. n.

(Figs 101, 261)

Description. Mandibles moderately long, stout and quite weakly narrowed, apically twisted 15–25°; upper mandibular tooth slightly compressed to subcylindrical, 1.4–1.7 times as long as the lower tooth which is stout and compressed; outer mandibular surface with scattered fine pubescence, more or less flat except for a basal concavity. Labrum 0.4–0.5 times as long as broad; malar space 0.4–0.5 times as long as basal mandibular width. Clypeus in profile convex, margin blunt; clypeus in front view 1.3–1.4 times as broad as long, the margin apically weakly convex. Lower face 0.70–0.75 times as broad as long, polished, centrally sparsely punctate. Head in dorsal view with genae rounded behind eyes; posterior ocellus close to eye; FI = 65–70%; occipital carina mediodorsally complete, ventrally curved to join hypostomal carina about 0.9 times the basal mandibular width away from mandible. Antenna long and slender, with 62–64 flagellar segments; 20th segment 2.2–2.7 times as long as broad.

Mesoscutum polished, finely punctate, in profile evenly rounded; notauli absent. Mesopleuron polished, the upper part finely punctate, the lower part granularly punctate to punctostriate; epicnemial carina curved towards but not reaching anterior margin of pleuron. Scutellum in profile weakly convex, laterally carinate for all of its length; scutellum in dorsal view 1.4–1.6 times as long as anteriorly broad, smooth, with a few striae posteriorly. Metapleuron moderately strongly convex, polished, finely punctate, at most with a few weak rugae; submetapleural carina very weakly broadened anteriorly; posterior transverse carina of mesosternum complete. Propodeum in profile evenly declivous; anterior transverse carina complete except at lateral extremities, posterior transverse carina absent; anterior area moderately long, steep, striate; spiracular area moderately long, smooth; posterior area reticulate, tending to grade to concentrically striate, especially centrally; lateral longitudinal carina present only as a vestige anteriorly, not joined to spiracular margin by a short carina.

Fore wing length 14–15 mm; discosubmarginal cell as in Fig. 261; AI = 1.00–1.31; CI = 0.25–0.33; ICI = 0.40–0.49; SDI = 1.10–1.18; *cu-a* proximal to base of *Rs&M* by about 0.1 times its own length; marginal cell proximally evenly hirsute; 1st subdiscal cell more or less entirely hirsute except for proximal and posterior margins. Hind wing with 6–8 hamuli on *R*1; 1st abscissa of *Rs* straight, 2nd abscissa straight.

Fore leg with tibia weakly flattened, with scattered spines on outer surface. Mid leg with longer tibial spur 1.3–1.4 times length of the shorter. Hind leg with coxa in profile 1.8–1.9 times as long as deep; trochantellus dorsally 0.4 times as long as broad; 4th segment of tarsus 2.7–2.9 times as long as broad; claws of female long and evenly curved, with long close pectinae; claws of male similar but with pectinae shorter and sparser.

Gaster long and slender; tergite 2 in profile 5.0–6.0 times as long as posteriorly deep, laterotergite narrow, anteriorlypendant, posteriorly pendant or up-turned; thyridia large, narrowly elliptical and separated from anterior margin of tergite by about 2–3 times its own length. Ovipositor slender, its sheath moderately slender. Male with sternites 7–9 bearing fine, semidecumbent hairs; gonosquama elongate, tapered; aedeagus slender, slightly flattened, laterally with a narrow longitudinal flange, without a collar or crest (Fig. 101).

Colour generally orange, with irregular yellow patches on alitrunk dorsally and laterally; head paler yellow; interocellar area black; antenna proximally yellowish brown, distally infuscate; pterostigma yellowish brown; wings almost hyaline.

Variation. The specimens from Nuevo León have the terminal segments of the gaster darker than specimens from other Mexican states.

Remarks. This species is named in honour of Rudolfo Dirzo for his contribution to Mexican conservation biology.

The form of the alar sclerites, the large labrum and the (at least anteriorly) pendant laterotergite 2 are apomorphic features uniting *E. dirzoi* with the *trilineatus* species-group. *E. dirzoi* differs from many other species in this complex in having a simple aedeagus, a feature that suggests it may be one of the more primitive members of the group. Other species in the *trilineatus* group with an unspecialized aedeagus are *E. lupemejia* and *E. porteri*. *E. dirzoi* differs from these two species in the form of the alar sclerites (see Figs 258, 259, 261).

Biological Information. *Enicospilus dirzoi* is only known to occur in northern and central Mexico. No further information is available about its habitat preferences, and its hosts are unknown.

Material Examined

Holotype ♂, **Mexico**: Morelos, Cuernavaca, vi.1904 (*Smith*) (BMNH).

Paratypes. **Mexico**: Guerrero: 1 ♂, Amula, 2000 m, viii.1904 (*Smith*) (BMNH): Nuevo León: 1 ♀, Cola de Caballo, El Cercado, vi.1976 (*Porter*) (FSCA); 1 ♂, Cola de Caballo, Monterrey, vi.1975 (*Porter & Weems*) (FSCA); 1 ♂, 2 ♀, Mesa de Chipinque, Monterrey, vi.1976 (*Porter*) (FSCA): Tabasco: 1 ♂, Teapa, iii.1904 (*Smith*) (BMNH)

Enicospilus masneri sp. n.

(Figs 106, 262)

DESCRIPTION. Mandibles moderately long, proximally quite strongly narrowed, distally weakly tapered, apically twisted 20–30°; upper mandibular tooth subcylindrical, 1.2–1.4 times as long as the lower tooth; outer mandibular surface sparsely hirsute, with a distinct proximal concavity, weakly concave distally. Labrum 0.2–0.3 times as long as broad; malar space 0.2 times as long as basal mandibular width. Clypeus in profile strongly convex, margin impressed, flat and acute; clypeus in front view 1.40–1.50 times as broad as long, margin weakly convex. Lower face 0.70–0.75 times as broad as long, polished, with inconspicuous punctures. Head in dorsal view with genae strongly constricted behind eyes; posterior ocellus very close to eye; FI = 70–75%; occipital carina mediodorsally complete, convex, ventrally curved to join hypostomal carina about 0.70 times the basal mandibular width away from mandible. Antenna long and slender, with 62–64 flagellar segments; 20th segment 2.2–2.3 times as long as broad.

Mesoscutum weakly polished, impunctate, in profile strongly rounded; notauli vestigial. Mesopleuron polished, the upper part smooth, ventrally becoming striate; epicnemial carina curved towards anterior margin of pleuron. Scutellum in profile weakly convex, laterally carinate for all of its length; scutellum in dorsal view 1.3–1.4 times as long as anteriorly broad, rather smooth. Metapleuron moderately convex, with shallow close punctures; submetapleural carina evenly anteriorly broadened; posterior transverse carina of mesosternum complete. Propodeum in profile evenly declivous; anterior transverse carina complete, posterior transverse carina absent; anterior area short, rugulose; spiracular area very long, smooth; posterior area finely wrinkled with the wrinkles tending to curve forward from the lateral edge towards the centre; lateral longitudinal carina complete, joined to spiracular margin by a short carina.

Fore wing length 11–12 mm; discosubmarginal cell as in Fig. 262; AI = 1.50–1.63; CI = 0.63–0.71; ICI = 0.49–0.50; SDI = 1.48–1.59; *cu-a* proximal to the base of *Rs&M* by about 0.2 of its length; marginal cell proximally evenly hirsute; 1st subdiscal cell hirsute centrally, peripherally glabrous; 2nd subdiscal cell with a glabrous arc close to *Cu*1. Hind wing with 6–7 hamuli on *R*1; 1st abscissa of *Rs* long and weakly bowed, 2nd abscissa slightly sinuate; distal abscissa of *Cu*1 unusual in being strongly sinuate (Fig. 106).

Fore leg with tibia subcylindrical, with isolated spines on outer surface. Mid leg with longer tibial spur 1.6 times length of the shorter. Hind leg with coxa in profile 2.0 times as long as deep; trochantellus dorsally 0.1 times as long as broad; 4th segment of tarsus 3.2–3.3 times as long as broad; claws of female closely and evenly pectinate.

Gaster slender; tergite 2 in profile more than 5 times as long as posteriorly deep, laterotergite more or less folded under, thyridia elliptical and separated from anterior margin of tergite by about 3–4 times its own length. Ovipositor slender, its sheath narrow. Male unknown.

Colour generally uniformly pale yellowish; interocellar area black; antenna yellowish, distally infuscate; pterostigma blackish, proximally and distally pallid; wings hyaline, but with proximal corner of marginal cell infumate.

VARIATION. None obvious.

REMARKS. This species is named in honour of the distinguished Canadian hymenopterist Lubomir Masner who collected the holotype.

Enicospilus masneri is one of the most distinctive species in the genus on account of the wings. There is a tendency for the wing hairs to be concentrated along the veins and fold lines, and for them to be sparser along the periphery of many cells (Figs 106, 262). The characteristic venation of the hind wing is a unique feature of this species. *E. masneri* has a pronounced glabrous arc in the 2nd subdiscal cell of the fore wing, an unusual feature which it shares with *E. dajaboni* and *E. carlota*. However, it does not possess any of the apomorphic features characterizing the *trilineatus* species-complex, and thus presumably is not closely related to *E. carlota* and *E. dajaboni*.

BIOLOGICAL INFORMATION. *Enicospilus masneri* is only known to occur on the Caribbean island of Hispaniola, where it has been collected at altitudes between 300 and 400 m. Its host is not known.

MATERIAL EXAMINED

Holotype ♀, **Dominican Republic**: La Cumbre, P. Plata Prov., 300 m, iii.1978 (*Masner*) (TC).

Paratype. **Dominican Republic**: 1 ♀, Dajabon Prov., 13 km S. Loma de Cabrera, 400 m, v.1973 (*Davis*) (USNM).

Enicospilus randalli **sp. n.**

(Figs 173, 263, 275)

[*Enicospilus cressoni* Hooker; Townes, 1939: 300. Misidentification.]

DESCRIPTION. Mandibles moderately long, rather evenly narrowed, apically twisted 20–30°; upper mandibular tooth depressed, 1.3–1.5 times as long as the lower tooth; outer mandibular surface weakly concave, with fine scattered pubescence. Labrum 0.2 times as long as broad; malar space 0.3 times as long as basal mandibular width. Clypeus in profile weakly convex, margin blunt; clypeus in front view 1.2–1.5 times as broad as long, with margin weakly convex apically (Fig. 173). Lower face 0.66–0.73 times as broad as long, punctate, tending to be punctostriate centrally. Head in dorsal view with genae constricted behind the eyes; posterior ocellus very close to eye; FI = 60–65%; occipital carina mediodorsally complete, ventrally curved to join hypostomal carina about 0.8–1.0 times the basal mandibular width away from mandible. Antenna long, rather slender, with 55–59 flagellar segments; 20th segment 1.7–1.8 times as long as broad.

Mesoscutum polished, finely punctate, in profile evenly but rather steeply rounded; notauli vestigial. Mesopleuron polished, the upper part punctate, the lower part punctostriate or striate; epicnemial carina curved towards anterior margin of pleuron. Scutellum in profile weakly convex, laterally carinate for all of its length, though sometimes with carinae posteriorly weak; scutellum in dorsal view 1.5–1.6 times as long as anteriorly broad, punctate, posteriorly wrinkled. Metapleuron weakly convex, diagonally striate; submetapleural carina evenly anteriorly broadened; posterior transverse carina of mesosternum complete. Propodeum in profile evenly rounded; anterior transverse carina complete, posterior transverse carina absent; anterior area moderately long, striate; spiracular area quite long, smooth; posterior area reticulate-wrinkled, in some specimens tending to concentrically striate; lateral longitudinal carina present only anteriorly as a vestige, joined to spiracular margin by a short carina.

Fore wing length 14–15 mm; discosubmarginal cell as in Figs 263, 275; AI = 0.96–1.30; CI = 0.20–0.29; ICI = 0.38–0.54; SDI = 1.12–1.25; *cu-a* from slightly proximal to the base of *Rs&M* to proximal to it by about 0.3 times its own length; marginal cell proximally slightly more sparsely pubescent than centrally; 1st subdiscal cell with anterior 0.5 hirsute. Hind wing with 6–7 hamuli on *R*1; 1st abscissa of *Rs* straight, 2nd abscissa very weakly arcuate.

Fore leg with tibia subcylindrical, with fine, scattered spines on outer surface. Mid leg with longer tibial spur 1.5–1.6 times length of the shorter. Hind leg with coxa in profile 1.7–1.8 times as long as deep; trochantellus dorsally 0.1 times as long as broad; 4th segment of tarsus 2.4–2.5 times as long as broad; claws of female with fine, close pectinae, those of male similar but pectinae shorter.

Gaster long and slender; tergite 2 in profile at least 5 times as long as posteriorly deep, laterotergite turned under, thyridia elliptical and separated from anterior margin of tergite by about 4–6 times its own length. Ovipositor slender, its sheath narrow. Male with sternites 7–9 bearing long, stout, erect hairs; gonosquama evenly rounded.

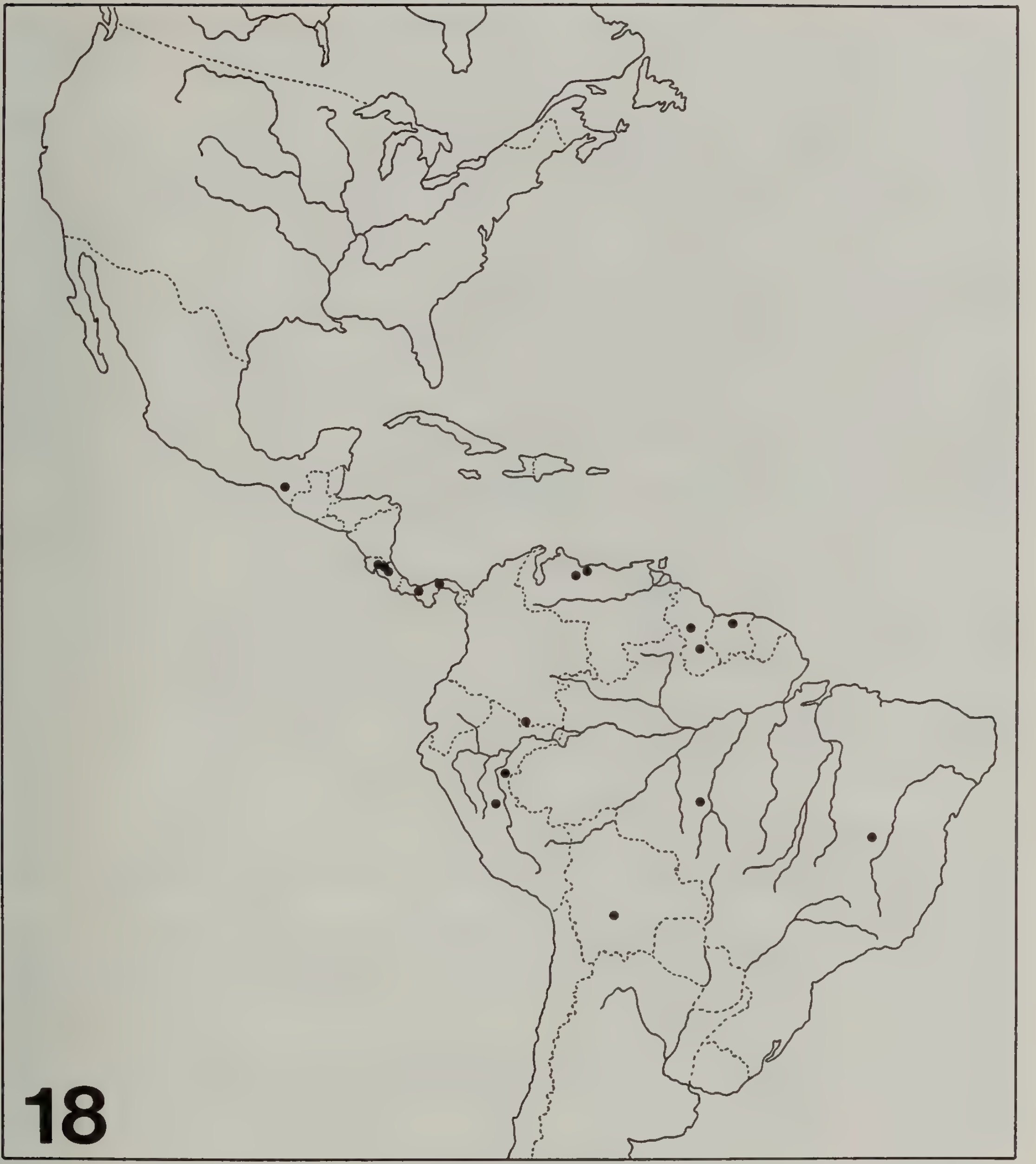
Colour generally orange, with mesoscutum paler with three longitudinal dark marks; interocellar area black; antennae and tergites 3+ of gaster blackish; pterostigma reddish brown to dark brown; wings hyaline or very weakly uniformly infumate.

VARIATION. There is some variation in the extent of the development of the lateral longitudinal carina of the metapleuron; it usually extends back to near level of spiracle, but in some individuals it is longer and very rarely it is complete. The Panamanian specimens to hand have this carina more or less complete and have the metapleural striae weak; in one specimen the metapleuron is more or less evenly punctate. Although the interocellar area is black in 90% of the specimens a few individuals have it weakly infuscate; odd individuals have this area only black between the posterior ocelli and about 3% of specimens have it uniformly yellow.

REMARKS. This species is named in honour of Randall Garcia who has done an excellent job developing the administration of the Guanacaste National Park project.

Enicospilus randalli is fairly easily recognizable by the combination of straight *Rs+2r*, small fenestra, single alar sclerite, striate metapleuron (most individuals) and black interocellar area (most individuals). I have seen several specimens of this species determined as *E. cressoni*. The two are rather similar but there are consistent differences which suggest they are separate species (see under *E. cressoni* for more details).

BIOLOGICAL INFORMATION. *Enicospilus randalli* is a widespread Neotropical species whose range extends from 18°N in Chiapas, southern Mexico, south to about 18°S in Brazil (Map 18). It has been collected at a variety of altitudes from near sea-level up to about 1800 m, and in a variety of habitats. It is rather infrequently collected in wet forest sites (such as Barro Colorado Island and Monteverde) but it is most



Map 18 Localities at which *Enicospilus randalli* has been collected.

commonly encountered in seasonally dry forest. In Santa Rosa National Park *E. randalli* has been collected quite frequently at a light overlooking dry forest. Most specimens have been taken at the start of the wet season. The cumulative totals collected at light between 1982 and 1986 show the following seasonal distribution:

J	F	M	A	M	J	J	A	S	O	N	D
1	–	–	–	11	27	15	3	3	–	–	1

At Estacion Mengo (= Finca La Luz) at 1100 m on Volcán Cacao, Costa Rica, *E. randalli* is one of the commonest species of the genus at light in July.

Although relatively few specimens have been collected on Barro Colorado Island, all were taken between April and July, suggesting that *E. randalli* may be similarly seasonal at this site. Although it is common *E. randalli* has never been reared so it is not known what species serve as hosts for this insect.

MATERIAL EXAMINED

Holotype ♀, **Costa Rica**: Guanacaste Prov., Volcán Cacao, Finca La Luz [= Estacion Mengo], 1100 m, viii.1986 (*Janzen & Hallwachs*) (BMNH).

Paratypes. **Bolivia**: 1 ♀, Alto Palmar, Cochabamba, ix.1960, (*Walz*) (TC); 1 ♀, Chapare, Alto Palmar, 1100 m, ii.1961 (CNC). **Brazil**: 2 ♂, 3 ♀, Bahia, Encruzilhada, xi.1972 (*Alvarenga*) (TC); 2 ♂, 2 ♀, Mato Grosso, Sinop, x.1974–76 (*Alvarenga*) (TC); 1 ♂, Mato Grosso, ii.1968 (*Richards*) (BMNH); 1 ♂, Mato Grosso, vii.1968 (BMNH). **Colombia**: 1 ♂, Rio Putumayo, Puerto Arica, vii.1978 (*Tidwell*) (FSCA). **Costa Rica**: Cartago Prov.: 1 ♂, 8 km S. Casa Mata, 216 km S. San Isidro de Tejar, 1800 m, xii.1983 (*Janzen & Hallwachs*) (BMNH): Guanacaste Prov.: 1 ♀, Cerro el Hacha, Casa Oeste, 400 m, x.1987 (*Chacon*) (BMNH); 3 ♂, Santa Rosa National Park, 300 m, vii.1978 (*Janzen*) (BMNH); 16 ♂, 20 ♀, same locality, vi.1980, vi-viii.1982, vii-ix,xii.1983, i,v-viii.1984, v.1985 (*Janzen & Hallwachs*) (BMNH); 6 ♀, same locality, vi.1985 (*Gauld*) (BMNH); 6 ♀, same locality, v. 1986 (*Gauld*) (BMNH); 5 ♀, Volcán Cacao, Finca La Luz [= Estacion Mengo], 1100 m, viii.1986 (*Janzen & Hallwachs*) (BMNH); 5 ♂, 34 ♀, same locality, vii-xi.1987 (*Janzen & Hallwachs*) (BMNH, MNCR); 1 ♀, Volcán Orosi, Casa Mariksa [= Maritza], 800 m, vi.1986 (*Gauld*) (BMNH): Puntarenas Prov.: 4 ♀, Monteverde, 13–1400 m, vii.1982 (*Janzen & Hallwachs*) (BMNH); 1 ♀, same locality, vi.1986 (*Haber*) (BMNH): San José Prov.: 1 ♂, Estacion Carrillo, Braulio Carrillo National Park, 700 m, i.1985 (*Chacon* & Chacon) (BMNH); 1 ♂, Estacion Zurqui (el Tunel), Braulio Carrillo National Park, 1500 m, ix.1985 (*Chacon & Chacon*) (BMNH). **Guyana**: 2 ♀, Essequibo R., Moraballi Creek, viii.1929 (*Oxf.Univ.Exp.*) (BMNH); 1 ♂, Tumatumari, Potaro R. xii.1915 (*Bodkin*) (BMNH). **Mexico**: Chiapas; 1 ♂, Rancho Nuevo, 14 km S. San Cristobal las Casas, viii.1966 (*Breedlove & Emmel*) (CNC); 1 ♂, 32 km N. Huixtla, vi.1969 (*Mason*) (CNC). **Panama**: 1 ♀, Barro Colorado Island, iv.1941 (*Zetek*) (USNM); 1 ♀, same locality, iv.1978 (*Wolda*) (RNH); 1 ♂, same locality, iv.1979 (*Wolda*) (TC); 2 ♂, 3 ♀, same locality, vii.1983, vi-vii.1985 (*Wolda*) (BMNH); 1 ♀, Cerro Campana, nr Chica, iv.1965 (*Duckworth*) (USNM). **Peru**: 1 ♀, Avispas, nr Marcapata, ix.1962, (*Peña*) (TC); 1 ♂, Loreto Pucallpa, ii.1962 (*Schunke*) (BMNH). **Surinam**: 1 ♀, Paramaribo, Charlesbury, v.1941 (*Geijskes*) (RNH). **Venezuela**: 1 ♂, 1 ♀, Aragua, Rancho Grande, iv.1960 (*Test*) (UM); 2 ♀, El Junquito, D[istrito] F[ederale], iv.1938 (*Berthier*) (TC).

Enicospilus cressoni Hooker

(Fig. 264)

Enicospilus cressoni Hooker, 1912: 62. Lectotype ♀, MEXICO (PANS), designated by Townes & Townes (1966: 176) [examined].

DESCRIPTION. Mandibles moderately long, evenly narrowed, apically twisted 40–60°; upper mandibular tooth cylindrical to slightly depressed, 1.5–1.7 times as long as the lower tooth which is slightly depressed and slender; outer mandibular surface sparsely pubescent, more or less flat, with weak proximal concavity. Labrum 0.2–0.3 times as long as broad; malar space 0.3–0.4 times as long as basal mandibular width. Clypeus in profile moderately convex, margin subacute; clypeus in front view 1.15–1.30 times as broad as long, with margin weakly convex apically. Lower face 0.60–0.67 times as broad as long, weakly polished, centrally more or less smooth. Head in dorsal view with genae evenly constricted behind eyes; posterior ocellus almost contiguous with eye; FI = 70–75%; occipital carina mediodorsally complete, ventrally curved to join hypostomal carina about 0.9 times the basal mandibular width away from mandible. Antenna slender, with about 57–59 flagellar segments; 20th segment 2.1–2.4 times as long as broad.

Mesoscutum polished, obsoletely punctate, in profile evenly rounded; notauli vestigial. Mesopleuron polished, the upper part weakly to moderately strongly punctostriate, the lower part similar; epicnemial carina weakly curved towards anterior margin of pleuron, with its lower corner rather sharp. Scutellum in profile weakly convex, laterally carinate for most of its length; scutellum in dorsal view 1.5–1.6 times as long as anteriorly broad, smooth, with strong posterior striae. Metapleuron moderately convex, diagonally striate; submetapleural carina evenly anteriorly broadened; posterior transverse carina of mesosternum complete. Propodeum in profile abruptly declivous; anterior transverse carina complete, posterior transverse carina absent; anterior area deeply impressed, striate; spiracular area short, finely punctate; posterior area irregularly wrinkled; lateral longitudinal carina present at least on anterior 0.5, joined to spiracular margin by a short carina.

Fore wing length 14–15 mm; discosubmarginal cell as in Fig. 264; AI = 0.96–1.30; CI = 0.08–0.24; ICI = 0.40–0.48; SDI = 0.95–1.05; *cu-a* proximal to the base of *Rs&M* by about 0.2 times its own length;

marginal cell proximally slightly more sparsely hirsute than it is centrally; 1st subdiscal cell with scattered hairs distally. Hind wing with 6 hamuli on *R*1; 1st abscissa of *Rs* weakly but distinctly curved, 2nd abscissa almost straight.

Fore leg with tibia weakly flattened, with fine scattered spines on outer surface. Mid leg with longer tibial spur 1.4–1.9 times length of the shorter. Hind leg with coxa in profile 1.8–1.9 times as long as deep; trochantellus dorsally 0.1–0.2 times as long as broad; 4th segment of tarsus 2.4–2.5 times as long as broad; claws of female moderately long, with short close pectinae, those of putative male similar.

Gaster slender; tergite 2 in profile more than 5 times as long as posteriorly deep, laterotergite folded under, thyridia elliptical and separated from anterior margin of tergite by about 3.5 times its own length. Ovipositor slender, its sheath narrow. Putative male with sternites 7–9 bearing dense long fine semierect pubescence.

Colour generally brownish yellow with head and scutullem brighter yellow, and with gaster weakly infuscate beyond tergite 2; interocellar area infuscate to black; antenna proximally yellowish, distally infuscate; pterostigma yellowish; wings weakly infumate.

Variation. The male resembles the typical females in most features but has blackish antennae, is more polished, lacks pleural sculpture, has a smooth propodeum and does not have a carina joining the spiracle to the lateral longitudinal carina.

Remarks. It is with some hesitation that the male is associated with this species. Further collecting is needed to see if this association is warranted.

Enicospilus cressoni previously has been confused with *E. randalli*, a similar, and generally very much commoner species. The two may be separated as follows.

E. cressoni	*E. randalli*
Rs+2*r* weakly sinuous	*Rs*+2*r* virtually straight
Fenestra quite large	Fenestra short
Distal sclerite weak but discernible	Distal sclerite absent
SDI = 0.95–1.05	SDI = 1.12–1.25

These two species also differ subtly in a number of other features including the shape of the proximal sclerite (compare Figs 263, 264), the form of the mandible and the shape of the hind tarsal claws.

Biological Information. *Enicospilus cressoni* is only known to occur in Central America from Mexico south to Costa Rica, in Florida and on the larger Caribbean islands. Very few specimens have ever been collected, and nothing is known about the species' habitat preferences. In the Florida State Collection of Arthropods is a female which has allegedly been reared from the 'pupa' of *Gonodonta nutrix* (Cramer) (Lepidoptera: Noctuidae). It is accompanied by its elongate brownish, centrally pale-banded cocoon, but no other host remains, so it is doubtful that the ophionine actually emerged from a host pupa. More likely it destroyed the larval host after this host had constructed a cocoon.

Material Examined

Lectotype ♀, **Mexico**: no further data (PANS). Paralectotypes: **Dominican Republic**: 1 ♀, no further data (PANS). Mexico: 1 ♀, no further data (TC).

Costa Rica: 1 ♂, Monteverde, xii.1961 (*Palmer*) (TC). **Cuba**: 1 ♀, Baragua, xi.1927 (*Scaramuzza*) (MCZ). **U.S.A.**: Florida: 1 ♀, White City, xii.1961 (*Bullock*) (FSCA).

Enicospilus laurenae sp. n.

(Figs 176, 177, 265)

Description. Mandibles moderately short, quite strongly narrowed ventrally so there is a deep acute ventral lobe, apically twisted 20–30°; upper mandibular tooth subcylindrical, 1.3–1.6 times as long as the lower tooth which is unusually broad and has a ventrobasal swelling which is ventrally sharp (Fig. 176); outer mandibular surface more or less flat with a weak proximal concavity, the whole surface bearing scattered fine pubescence. Labrum 0.2–0.3 times as long as broad; malar space 0.3 times as long as basal mandibular width. Clypeus in profile moderately convex, margin impressed, flat and sharp; clypeus in front view 1.2–1.4 times as broad as long, with margin weakly convex apically. Lower face 0.65–0.70 times as broad as long, polished, punctate. Head in dorsal view with genae constricted behind eyes; posterior ocellus contiguous with eye; FI = 65–70%; occipital carina mediodorsally complete, ventrally curved to join hypostomal carina about 0.8–0.9 times the basal mandibular width away from mandible. Antenna moderately long and slender, with 55–57 flagellar segments; 20th segment 2.0–2.2 times as long as broad.

Mesoscutum polished, finely punctate, in profile evenly rounded; notauli present as short shallow impressions. Mesopleuron polished, the upper part punctate with part immediately above the broad shallow pit concentrically punctostriate, the lower part punctate; epicnemial carina inclined towards anterior margin of pleuron with its upper end quite strongly curved forwards, evanescent. Scutellum in profile weakly convex, laterally carinate for all of its length; scutellum in dorsal view 1.4–1.5 times as long as anteriorly broad, punctate, posteriorly striate. Metapleuron moderately convex, punctate (Fig. 177); submetapleural carina weakly anteriorly broadened, often expanded rather abruptly into a small anterior lobe; posterior transverse carina of mesosternum generally broadly interrupted centrally. Propodeum in profile rather abruptly declivous; anterior transverse carina present except at extreme lateral edges, posterior transverse carina absent; anterior area long and quite deeply excavate, wrinkled; spiracular area of moderate length, smooth; posterior area transversely coarsely wrinkled; lateral longitudinal carina absent except at extreme anterior end, not joined to spiracular margin by a short carina.

Fore wing length 14–15 mm; discosubmarginal cell as in Fig. 265; AI = 0.54–0.72; CI = 0.26–0.40; ICI = 1.05–1.30; SDI = 1.32–1.39; *cu-a* proximal to base of *Rs&M* by about 0.2 times its own length; marginal cell proximally evenly hirsute; 1st subdiscal cell with anterior and distal parts extensively hirsute. Hind wing with 6 hamuli on *R*1; 1st abscissa of *Rs* straight, 2nd abscissa weakly curved.

Fore leg with tibia weakly flattened, with scattered stout spines on outer surface. Mid leg with longer tibial spur 1.3–1.6 times length of the shorter. Hind leg with coxa in profile 1.6–1.7 times as long as deep; trochantellus dorsally 0.1 times as long as broad; 4th segment of tarsus 2.0–2.3 times as long as broad; claws of female evenly curved, bearing long pectinae; those of male similar but with pectinae shorter.

Gaster a little shorter and stouter than is usual for species of this genus; tergite 2 in profile 3.5–4.0 times as long as posteriorly deep, laterotergite turned under, thyridia broadly oval and separated from anterior margin of tergite by about 4 times its own length. Ovipositor basally stout, distally slender, its sheath quite broad. Male with sternites 7–9 bearing dense long stout erect hairs; gonosquama distally evenly rounded Colour generally orange-brown, face and orbits paler yellow, gaster with tergites 3+ blackish; interocellar area yellowish, slightly infuscate between the posterior ocelli; antenna black, sometimes with the scape blackish brown; pterostigma blackish; wings very weakly uniformly infumate.

VARIATION. One Costa Rican specimen (from Tortuguero) is slightly darker coloured than the others.

REMARKS. This species is named after Lauren Chapman (who is also found in damp places) with thanks for the cake.

Enicospilus laureni is easily recognized by the following combination of features; having the ICI> 1.00; having the lower tooth of mandible swollen ventrally; having the posterior transverse carina of mesosternum centrally weak or interrupted; having the metapleuron punctate; lacking a central sclerite. Structurally it resembles *E. vegai* (see that species).

BIOLOGICAL INFORMATION. *Enicospilus laurenae* is widely distributed from Costa Rica south to Ecuador. It is an uncommon insect in collections so little is known of its habitat preferences, but the Costa Rican and Panamanian specimens were collected in wet forest. It is perhaps noteworthy that *E. laureni* has never been collected in seasonally dry forests, despite the fact that this was the most intensively sampled habitat in this study. This species has never been reared.

MATERIAL EXAMINED

Holotype ♂, **Costa Rica**: Limon Prov., Cerro Tortuguero, N. edge Tortuguero National Park, 0–100 m, v.1984 (*Janzen & Hallwachs*) (BMNH).

Paratypes. **Costa Rica**: Cartago Prov.: 1 ♂, IICA, Turrialba, viii.1963 (*Porter*) (USNM). **Ecuador**: 1 ♂, Balzapomba, vi.1938 (*MacIntyre*) (TC). **Panama**: 1 ♀, Barro Colorado Island, xi.1941 (*Zetek*) (USNM).

Enicospilus vegai sp. n.

(Figs 178, 266)

DESCRIPTION. Mandibles quite long, proximally evenly tapered, distally more or less parallel-sided, its apex twisted 20–30°; upper mandibular tooth slightly depressed, 1.3–1.5 times as long as the lower which is stouter, slightly compressed, and swollen ventrally; outer mandibular surface sparsely pubescent, more or less flat with a weak proximal concavity. Labrum 0.2 times as long as broad; malar space 0.2 times as long as basal mandibular width. Clypeus in profile weakly convex, margin blunt; clypeus in front view 1.3–1.4 times as broad as long, its margin weakly convex. Lower face 0.65–0.68 times as broad as long, polished, punctate. Head in dorsal view with genae rounded; posterior ocellus contiguous eye; FI = 75–80; occipital carina mediodorsally complete, ventrally curved to join hypostomal carina about 0.9 times the basal mandibular width away from mandible. Antenna long and slender, with 66–69 flagellar segments; 20th segment 1.9–2.1 times as long as broad.

Mesoscutum polished, finely punctate, in profile evenly rounded; notauli vestigial. Mesopleuron polished, the upper part punctate, the lower part punctostriate grading centrally to striate; epicnemial carina inclined towards anterior margin of pleuron, its upper end weak and curved. Scutellum in profile weakly convex, laterally carinate for all of its length; scutellum in dorsal view 1.6–1.7 times as long as anteriorly broad, punctate, posteriorly wrinkled. Metapleuron weakly convex, striate grading anteroventrally to punctate (Fig. 178); submetapleural carina not distinctly broadened anteriorly; posterior transverse carina of mesosternum complete. Propodeum in profile evenly declivous; anterior transverse carina complete except lateral extremities, posterior transverse carina absent; anterior area deeply excavate, striate; spiracular area moderately long, smooth, posterior area reticulate laterally, centrally with rugae tending to be concentric; lateral longitudinal carina present only as an anterior vestige, sometimes joined to spiracular margin by a short weak carina.

Fore wing length 17–18 mm; discosubmarginal cell as in Fig. 266; AI = 0.61–1.00; CI = 0.28–0.39; ICI = 0.69–0.83; SDI = 1.20–1.25; *cu-a* proximal to the base of *Rs&M* by about 0.2–0.3 times its own length; marginal cell proximally more or less uniformly hirsute; 1st subdiscal cell hirsute except for posterior and proximal margins. Hind wing with 7 hamuli on *R*1; 1st abscissa of *Rs* straight, 2nd abscissa almost straight.

Fore leg with tibia slightly flattened, with numerous, slender spines on outer surface. Mid leg with longer tibial spur 1.4–1.5 times length of the shorter. Hind leg with coxa in profile 1.7–1.8 times as long as deep; trochantellus dorsally.

VARIATION. Structurally this is a remarkably uniform species and the Brazilian specimens are virtually identical to the Mesoamerican individuals.

REMARKS. This species is named in honour of Gerardo Vega for his tireless efforts as a research assistant for Daniel Janzen.

Enicospilus vegai can be recognized by the combination of the stout, ventrally swollen lower tooth of the mandible, striate metapleuron and absence of central sclerite. A number of other Mesoamerican and Neotropical species have very similar mandibles to *vegai*, and these species also resemble each other in coloration and, usually, in the sculpture of the propodeum. Possibly they comprise a holophyletic group. In Central America this species-complex includes *E. laurenae* and *E. kelloggae*. Both may be distinguished from *E. vegai* because they have punctate metapleurae; *E. kelloggae* has a distinct central sclerite. *E. laurenae* may easily be separated from *E. vegai* by the features given in couplet 55.

BIOLOGICAL INFORMATION. *Enicospilus vegai* is a widely distributed species whose range extends from southern Costa Rica (9°N) south to Rio de Janeiro Province, Brazil (23°S). Nothing is known of the biology of this species.

MATERIAL EXAMINED

Holotype ♂, **Costa Rica**: Puntarenas Prov., Esquinas, nr Golfito (*Allen*) (MCZ).

Paratypes. **Brazil**: 2 ♀, Rio de Janeiro, Silva Jardin, viii.1974 (*Oliveira*) (TC). **Panama**: 1 ♂, Las Cumbres, v.1982 (*Wolda*) (TC).

Enicospilus baltodanorum sp. n.

(Figs 102, 104, 267)

DESCRIPTION. Mandibles moderately long, evenly narrowed, apically twisted 30–40°; upper mandibular tooth slender, depressed, 1.4 times as long as the lower tooth; outer mandibular surface finely pubescent, flat, but with a broad shallow proximal concavity. Labrum 0.3 times as long as broad; malar space 0.3 times as long as basal mandibular width. Clypeus in profile weakly convex, margin subacute; clypeus in front view 1.5 times as broad as long, the margin almost truncate (Fig. 102). Lower face 0.76 times as broad as long, centrally slightly granulate, closely punctate. Head in dorsal view with genae constricted behind eyes; posterior ocellus contiguous with eye; FI = 70%; occipital carina mediodorsally complete but weak, ventrally curved to join hypostomal carina about 0.5 times the basal mandibular width away from mandible. Antenna slender, with 61 flagellar segments; 20th segment 1.8 times as long as broad.

Mesoscutum weakly polished, shallowly punctate, in profile evenly rounded; notauli shallow, but extending back to level of tegulae. Mesopleuron polished, the upper part finely and closely punctate, the lower part with punctures more superficial and larger; epicnemial carina curved towards anterior margin of pleuron. Scutellum in profile moderately convex, laterally carinate for 0.6 of its length; scutellum in dorsal view 1.2 times as long as anteriorly broad, regularly punctate. Metapleuron rather weakly convex, punctate, with fine granulation between punctures (Fig. 104); submetapleural carina evenly anteriorly broadened; posterior transverse carina of mesosternum more or less complete. Propodeum in profile abruptly declivous; anterior transverse carina complete, posterior transverse carina absent; anterior area deep and long, finely striate; spiracular area short, punctate; posterior area finely irregularly wrinkled; lateral longitudinal carina present only anteriorly, but joined to spiracular margin by a short carina.

Fore wing length 18 mm; discosubmarginal cell as in Fig. 267; AI = 0.95; CI = 0.25; ICI = 0.89; SDI = 1.21; *cu-a* proximal to the base of *Rs&M* by 0.3 times its own length; marginal cell proximally evenly hirsute; 1st subdiscal cell with anterior and distal margins broadly hirsute. Hind wing with 8 hamuli on *R*1; 1st abscissa of *Rs* almost straight, 2nd abscissa straight.

Fore leg with tibia quite strongly flattened, with scattered spines on outer surface. Mid leg with longer tibial spur 1.5 times length of the shorter. Hind leg with coxa in profile 1.7 times as long as deep; trochantellus dorsally <0.1 times as long as broad; 4th segment of tarsus missing; claws of female with close even pectinae.

Gaster moderately stout; tergite 2 in profile 3.7 times as long as posteriorly deep, laterotergite folded under, thyridia oval and separated from anterior margin of tergite by about 3.5 times its own length. Ovipositor slender, its sheath moderately stout. Male unknown.

Colour generally pale yellowish, legs darker brownish yellow and with gaster weakly infuscate posteriorly; mesoscutum with three darker longitudinal stripes; interocellar area slightly infuscate centrally; antenna brownish, paler distally; pterostigma dark brown; wings weakly infumate.

REMARKS. This species is named after Jorge, Jorge Enrique and Aristides Baltodano who have been very supportive of the Guanacaste National Park project.

Enicospilus baltodanorum is a rather stout species that is most easily recognized by its almost quadrate scutellum and very characteristic alar sclerite. It is apparently closely related to *E. estradarum*, which it resembles in the form of the mandibles and possession of a complete distal sclerite. It also resembles *E. colini* in sculpture, but differs in having less strongly twisted mandibles, no lateral crest on the propodeum and a smaller ICI.

BIOLOGICAL INFORMATION. *Enicospilus baltodanorum* is only known to occur in Costa Rica. Nothing is known about its biology.

MATERIAL EXAMINED

Holotype ♀, **Costa Rica**: Puntarenas Prov., Esquinas, nr Golfito (*Allen*) (MCZ).

Enicospilus carri sp. n.

(Figs 105, 108, 268)

DESCRIPTION. Mandibles moderately long, proximally abruptly narrowed, distally weakly narrowed, apically twisted 60–70°; upper mandibular tooth rather slender, slightly depressed, 1.3–1.5 times as long as the slightly compressed lower tooth; outer mandibular surface with long fine hair centrally, rather flat with a weak proximal concavity. Labrum 0.2–0.3 times as long as broad; malar space 0.2–0.3 times as long as basal mandibular width. Clypeus in profile very weakly convex, margin subacute; clypeus in front view 1.4–1.5 times as broad as long, apically truncate. Lower face 0.63–0.66 times as broad as long, centrally shallowly punctate. Head in dorsal view with genae constricted behind eyes; posterior ocellus contiguous with eye; FI = 80–85%; occipital carina mediodorsally complete, ventrally curved to join hypostomal carina about 0.9 times the basal mandibular width away from mandible. Antenna long and slender, with apical flagellar segments missing; 20th segment 1.9–2.0 times as long as broad.

Mesoscutum polished with shallow fine scattered punctures, in profile evenly rounded with anterior margin strongly out-curved; notauli shallow but conspicuous. Mesopleuron polished, the upper part sparsely punctate, the lower part punctostriate to striate; epicnemial carina inclined towards anterior margin of pleuron, but with upper end evanescent (Fig. 108). Scutellum in profile weakly convex, laterally carinate for 0.9 or more of its length; scutellum in dorsal view 1.5–1.6 times as long as anteriorly broad, punctate, with isolated rugae posteriorly. Metapleuron moderately convex, diagonally striate (Fig. 105); submetapleural carina evenly anteriorly broadened; posterior transverse carina of mesosternum complete. Propodeum in profile abruptly rounded; anterior transverse carina complete except at lateral extremities, posterior transverse carina represented by a weak lateral crest; anterior area deeply excavate, with isolated rugae; spiracular area short, finely and closely punctate; posterior area rugose; lateral longitudinal carina present anteriorly, joined to spiracular margin by a short weak carina.

Fore wing length 18–19 mm; discosubmarginal cell as in Fig. 268; AI = 0.76–0.80; CI = 0.21–0.35; ICI = 0.81–1.00; SDI = 1.22–1.27; *cu-a* proximal to the base of *Rs&M* by 0.2–0.3 times its own length;

marginal cell proximally slightly more sparsely hirsute than it is centrally; 1st subdiscal cell with anterior and distal periphery hirsute. Hind wing with 7–8 hamuli on *R*1; 1st abscissa of *Rs* almost straight, 2nd abscissa straight.

Fore leg with tibia slightly flattened, with scattered conspicuous spines on outer surface. Mid leg with longer tibial spur 1.3–1.4 times length of the shorter. Hind leg with coxa in profile 1.7–1.8 times as long as deep; trochantellus dorsally <0.1 times as long as broad; 4th segment of tarsus 2.3–2.4 times as long as broad; claws of female unusually long, bearing long fine pectinae and distally abruptly rounded.

Gaster long and slender; tergite 2 in profile 5.5–6.0 times as long as posteriorly deep, laterotergite folded under, thyridia elliptical and separated from anterior margin of tergite by about 4.0–4.5 times its own length. Ovipositor slender, its sheath moderately narrow. Male unknown.

Colour generally brownish yellow, with three dark brown longitudinal vittae on the mesoscutum; gaster reddish brown; interocellar area yellowish, infuscate between posterior ocelli; antenna proximally blackish, distally brown; pterostigma brown; wings hyaline.

VARIATION. None remarkable.

REMARKS. This species is named in honour of Archie Carr for his intense conservation activities.

Enicospilus carri is quite similar to *E. stevensi* in general appearance but differs most conspicuously in colour pattern. *E. carri* has dark mesoscutal vittae and a more or less uniformly reddish brown gaster; *E. stevensi* has a more or less uniformly brownish mesoscutum and a yellowish gaster with the posterior tergites black. *E. stevensi* has a far more convex metapleuron than *E. carri* and the females have much broader ovipositor sheaths.

BIOLOGICAL INFORMATION. *Enicospilus carri* has a range which extends from Belize (17°N) south to about 3°S in Amazonas Province in Brazil. The species has only been collected in lowland rain forest. Its hosts are not known.

MATERIAL EXAMINED

Holotype ♀, **Belize**: Toledo, Columbia Forest Station, vii.1968 (*Hasse*) (BMNH).

Paratype. **Brazil**: 1 ♀, Amazonas Prov., Reserva Ducke, km 26 Manaus-Itacoatiara highway, v.1972 (*Munroe family*) (CNC).

Enicospilus colini **sp. n.**

(Figs 109, 269)

DESCRIPTION. Mandibles of moderate length, proximally strongly narrowed, apically twisted 50–60°; upper mandibular tooth subcylindrical, 1.5–1.9 times as long as the lower tooth; outer mandibular surface sparsely pubescent, relatively flat, with a small proximal concavity. Labrum 0.3 times as long as broad; malar space 0.3 times as long as basal mandibular width. Clypeus in profile convex, margin blunt; clypeus in front view 1.5–1.6 times as broad as long, with margin very weakly convex. Lower face 0.74–0.78 times as broad as long, closely, finely punctate. Head in dorsal view with genae rounded behind the eyes; posterior ocellus very close to eye; FI = 60–70%; occipital carina mediodorsally weak or, more usually, narrowly interrupted, ventrally curved to join hypostomal carina about 0.6–0.8 times the basal mandibular width away from mandible. Antenna long but stout, with 62–64 flagellar segments; 20th segment 1.6–1.9 times as long as broad.

Mesoscutum polished, finely punctate, in profile evenly rounded; notauli weakly impressed. Mesopleuron polished, the upper part closely punctate ventrally grading to punctostriate or even striate; epicnemial carina inclined towards anterior margin of pleuron, its lower corner acute (Fig. 109). Scutellum in profile moderately convex, laterally carinate to centre, behind this the carinae evanescent; scutellum in dorsal view 1.5–1.6 times as long as anteriorly broad, punctate. Metapleuron convex, anteroventrally punctate becoming coarsely striate or even rugose posterodorsally; submetapleural carina quite strongly broadened anteriorly; posterior transverse carina of mesosternum well developed, complete. Propodeum in profile abruptly declivous; anterior transverse carina complete, posterior transverse carina represented by lateral ridges; anterior area deeply impressed, striate; spiracular area short, smooth; posterior area reticulately wrinkled; lateral longitudinal carina present only anteriorly only as a vestige, not joined to spiracular margin by a short carina.

Fore wing length 21–25 mm; discosubmarginal cell as in Fig. 269; AI = 0.80–1.00; CI = 0.28–0.32; ICI = 1.35–1.45; SDI = 1.25–1.35; *cu-a* proximal to base of *Rs&M* by 0.1–0.3 times its own length; marginal cell proximally evenly hirsute; 1st subdiscal cell with anterior and distal margins hirsute. Hind wing with 6–8 hamuli on *R*1; 1st abscissa of *Rs* very weakly bowed, 2nd abscissa from straight to slightly sinuous.

Fore leg with tibia slightly flattened, with numerous long, slender spines on outer surface. Mid leg with longer tibial spur 1.3–1.5 times length of the shorter. Hind leg with coxa in profile 1.6–1.7 times as long as deep; trochantellus dorsally 0.1 times as long as broad; 4th segment of tarsus 2.2–2.4 times as long as broad; claws of female short, abruptly rounded apically, with close pectinae; claws of male similar but with pectinae slightly shorter.

Gaster quite slender; tergite 2 in profile 4–5 times as long as posteriorly deep, laterotergite folded under, thyridia oval and separated from anterior margin of tergite by about 5–6 times its own length. Ovipositor moderately slender, its sheath broad. Male with sternites 7–9 bearing long, stout, erect hairs; gonosquama evenly rounded.

Colour generally yellowish brown with head, scutellum and mesoscutal stripes paler yellowish; interocellar area yellow; antennae blackish at least on basal 0.3; pterostigma orange; wings weakly infumate.

Variation. There is considerable variation in the colour of the mesoscutum. In most specimens it is yellowish brown, with lateral and lateromedian longitudinal pale stripes. The majority of the specimens from Mexico and occasional individuals from Santa Rosa have the mesoscutum blackish, although the pale stripes are still present. The Panamanian specimen is generally darker in colour than any others. The male from Virgen de Socorro has a rather atrophied alar sclerite, a longer fenestra, an anteriorly more hirsute discosubmarginal cell and the occipital carina complete. Possibly it represents a separate species, so I have excluded it from the paratype series.

Remarks. This species is named after the anthropologist Dr Colin Chapman in gratitude for his help and companionship in the field.

Enicospilus colini may easily be recognized by the combination of the following features: the large ICI (>1.30); no central sclerite; epicnemial carina sharply angled ventrally; its large size (fore wing length >20 mm). *E. colini* is superficially similar to *E. stevensi*, but differs not only in the form of the venation, but usually in having an incomplete or weak occipital carina and no carina between the propodeal spiracle and the lateral carina.

Biological Information. *Enicospilus colini* is a widespread Neotropical species whose range extends from about 15°N in southern Mexico, south to about 26°S in north-eastern Argentina. It occurs from near sea-level up to an altitude of about 1400 m. In Santa Rosa National Park relatively few individuals have ever been collected at once, but isolated individuals turn up at light regularly. Their seasonal distribution may be summarized thus:

J	F	M	A	M	J	J	A	S	O	N	D
–	–	–	–	–	7	1	–	–	–	–	4

The June/July specimens were all females whilst those collected in December were all males. In the higher, wetter parts of Costa Rica I have seen females collected between October and March. Despite intensive collecting this species has never been taken on Barro Colorado Island, Panama. The hosts of this insect are unknown.

Material Examined

Holotype ♀, **Costa Rica**: Guanacaste Prov., Santa Rosa National Park, 300 m, vi.1985 (*Gauld*) (BMNH).

Paratypes. **Argentina**: 1 ♀, Misiones, x.1960 (Foerster) (CNC). **Colombia**: 1 ♂, Valle, Anchicaya, nr Buenaventura, 300 m, iv.1972 (*Cooper*) (BMNH). **Costa Rica**: Cartago Prov.: 1 ♀, 2 ♂, Turrialba, iii.1965 (*Duckworth*) (USNM): Guanacaste Prov.: 1 ♀, Rincón de la Vieja, 900 m, iii.1984 (*Janzen, Hallwachs & Gauld*) (BMNH); 2 ♂, Santa Rosa National Park, 300 m, xii.1979 (*Janzen*) (BMNH); 2 ♂, 4 ♀, same locality, vii.1982, v,vi,xii.1983 & vi.1984 (*Janzen & Hallwachs*) (BMNH); 1 ♀, same locality, vi.1986 (*Gauld*) (BMNH); 2 ♀, same locality, SE. of Entrada, vi.1986 (*Godfrey*) (BMNH): Heredia Prov.: 1 ♀, La Selva Biological Station, Puerto Viejo de Sarapiqui, 40 m, ii.1986 (*Chavarris & Chacon*) (BMNH): Puntarenas Prov.: 1 ♀, Monteverde, xii.1962 (*Palmer*) (TC); 1 ♀, Monteverde, 1350 m, i.1986 (*Forsyth*) (CNC): San José Prov.: 2 ♀, Estacion Carrillo, Braulio Carrillo National Park, 700 m, x.1984 (*Chacon*) (BMNH); 1 ♂, San José, i.1961 (*Palmer*) (TC). **Mexico**: Chiapas: 2 ♂, 32 km N. Huixtla, 1000 m, vi.1969 (*Mason*) (CNC); 1 ♂, 30–40 km N. Huixtla, 1000 m, vi.1969 (*Peterson*) (CNC); 2 ♂, 30–40 km N. Huixtla, 1000 m, vi.1969 (CNC); 1 ♀, Muste, nr Huixtla, 440 m, x.1970 (*Welling*) (CNC); 1 ♂, Municipio de Tzimol, 30 km SSE. Pugiltic, 762m, x.1981 (*Breedlove*) (CAS): Quintana Roo: 1 ♂, X-can, viii.1963 (*Welling*) (CNC). **Panama**: 1 ♀, Chiriqui, Fortuna, 1050 m, ii.1978 (*Wolda*) (RNH). **Peru**: 1 ♀, Quincemil, Cuzco, xi.1962 (*Peña*) (CNC).

Non-paratypic material. **Costa Rica**: Alajuela Prov.: 1 ♂, Virgen de Socorro, 800 m, ii.1987 (*Janzen & Hallwachs*) (BMNH).

Enicospilus maculipennis (Cameron)

(Fig. 270)

Ophion (*Enicospilus*) *maculipennis* Cameron, 1886: 292. Holotype ♀, PANAMA (BMNH) [examined].
Enicospilus maculipennis (Cameron) Ashmead, 1895: 547.
Henicospilus maculipennis (Cameron) Dalla Torre, 1901: 182.
Enicospilus parvifasciatus Cameron, 1911: 180. Holotype ♀, GUYANA (BMNH) [examined]. **Syn. n.**
Enicospilus parvifasciatus Cameron; Hooker, 1912: 87.
Stauropodoctonus maculipennis (Cameron) Morley, 1912: 18

DESCRIPTION. Mandibles quite long, proximally narrowed, distally almost parallel-sided, apically twisted 15–25°; upper mandibular tooth slightly compressed, 1.1–1.3 times as long as the lower; outer mandibular surface slightly concave, with scattered fine hairs. Labrum 0.3–0.4 times as long as broad; malar space 0.3–0.4 times as long as basal mandibular width. Clypeus in profile weakly convex, margin impressed, acute; clypeus in front view 1.25–1.45 times as broad as long, with margin apically weakly convex. Lower face 0.70–0.75 times as broad as long, polished with very fine punctures. Head in dorsal view with genae rounded behind eyes; posterior ocellus very close to eye; FI = 60–65%; occipital carina mediodorsally complete, ventrally curved to join hypostomal carina about 0.8–0.9 times the basal mandibular width away from mandible. Antenna long and slender, with 60–65 flagellar segments; 20th segment 2.8–3.3 times as long as broad.

Mesoscutum weakly polished, finely and inconspicuously punctate, in profile evenly rounded; notauli vestigial. Mesopleuron polished, the upper part finely punctate, the lower part similar but with a shallowly rugose band of sculpture extending from epicnemial carina towards base of mid coxa; epicnemial carina curved towards anterior margin of pleuron. Scutellum in profile weakly convex, laterally carinate for 0.7 or more of its length; scutellum in dorsal view 1.6–1.8 times as long as anteriorly broad, smooth or with striae posteriorly. Metapleuron moderately convex, punctate; submetapleural carina barely broadened anteriorly; posterior transverse carina of mesosternum complete. Propodeum in profile evenly rounded; anterior transverse carina complete, posterior transverse carina absent; anterior area short and quite shallowly impressed, with a few coarse striae; spiracular area long, with obsolescent punctures; posterior area coarsely and irregularly wrinkled; lateral longitudinal carina complete, at least anterior to transverse carina, joined to spiracular margin by a short and often weak carina.

Fore wing length 13–15 mm; discosubmarginal cell as in Fig. 270; AI = 1.05–1.67; CI = 0.44–0.64; ICI = 0.26–0.34; SDI = 1.19–1.39; *cu-a* opposite or slightly proximal to base of *Rs&M*; marginal cell proximally uniformly hirsute; 1st subdiscal cell with anterior and distal parts sparsely hirsute. Hind wing with 5–6 hamuli on *R*1; 1st abscissa of *Rs* weakly bowed, 2nd abscissa almost straight.

Fore leg with tibia not distinctly flattened, with slender scattered spines on outer surface. Mid leg with longer tibial spur 1.6–1.8 times length of the shorter. Hind leg with coxa in profile 1.7–1.9 times as long as deep; trochantellus dorsally 0.1–0.2 times as long as broad; 4th segment of tarsus 2.6–2.7 times as long as broad; claws of female short, strongly but evenly curved apically, with close regular pectinae; claws of male similar.

Gaster slender; tergite 2 in profile at least 6 times as long as posteriorly deep, laterotergite turned under, thyridia elliptical and separated from anterior margin of tergite by about 3 or more times its own length. Ovipositor slender, its sheath narrow. Male with sternites 7–9 bearing long fine erect pubescence; gonosquama quite long, distally rounded.

Colour generally pale yellow; antennae and interocellar area yellow; frons between antennae, occiput, propleuron, mesoscutal vittae, mesothorax ventrally and laterally on epicnemium, lower part of metapleuron, bases of mid and ventral parts of hind coxae black; pterostigma black, proximally and distally yellow; wings hyaline, proximal corner of marginal cell conspicuously infumate.

VARIATION. There is a considerable range of variation in the extent of the areas of black pigmentation. Some Costa Rican specimens have virtually all the mesopleuron black except for the upper 0.3 and a small area in the lower hind corner. The propodeum, pronotum, posterior 0.3 of tergite 1 and much of tergite 3 may be blackish also. Specimens from further south (Venezuela) are much less extensively dark and generally lack all gastral and coxal markings and frequently also those on the metathorax, propodeum and prothorax. The alar sclerite and pterostigma of Venezuelan specimens is also paler, and the punctures on the metathorax are finer and sparser. These specimens also lack the characteristic band of rugose sculpture on the mesopleuron.

REMARKS. *Enicospilus maculipennis* is most easily recognized by the characteristic coloration of the alitrunk, gaster and pterostigma, and by the infumation present at the base of the marginal cell. It is the only Neotropical species without a central sclerite that has the marginal cell infumate. The shape of the alar sclerite and the venation are also quite characteristic. In sculpture *E. maculipennis* resembles *E. flavoscutellatus* but it is not clear whether this similarity is due to evolutionary convergence or results from a close phylogenetic relationship.

Morley (1912) placed *maculipennis* in *Stauropodoctonus* (Morley's name for the genus now called *Stauropoctonus*) on account of its colour pattern; he subsequently (Morley, 1914) examined the holotype of *E. parvifasciatus* which he correctly recognized as being synonymous with *maculipennis*. However, the holotype of *E. parvifasciatus* was inadvertently labelled by Cameron as 'Enicospilus parvimaculatus' and Morley (1914) used this name when suggesting the synonymy. Consequently the synonymy which Morley correctly recognized has not been published, so I have formally established it above.

Biological Information. *Enicospilus maculipennis* is a Mesoamerican and northern South American species whose range extends from about 15°N in southern Mexico southwards to Ecuador, Colombia and Venezuela. It has been collected from near sea-level up to an altitude of 2300 m. It is known to occur in a variety of habitats, but despite quite intensive collecting it has not been collected in lowland rainforest on Barro Colorado Island, though it does occur in a more disturbed habitat at Las Cumbres. In Santa Rosa National Park *E. maculipennis* is regularly collected, but never in large numbers. The specimens from this site have the following aggregated seasonal distribution:

J	F	M	A	M	J	J	A	S	O	N	D
–	–	1	1	1	1	1	3	1	2	1	3

No hosts are known for this species.

Material Examined

Holotype ♀ (*Ophion* (*Enicospilus*) *maculipennis* Cameron), **Panama**: Bugaba (BMNH). Holotype ♀ (*Enicospilus parvifasciatus* Cameron), **Guyana** (BMNH).

Colombia: 3 ♀, Monterredondo, Cundinamarca, ii.1957, i-ii.1959 (*Foerster*) (CNC); 1 ♀, 41 km S. Santa Marta Magdalena, 2300 m, v.1973 (*Howden & Campbell*) (TC). **Costa Rica**: Guanacaste Prov.: Santa Rosa National Park, 300 m, 1 ♀, xii.1976, 3 ♀, viii-ix.1977, 1 ♀, v.1978, 1 ♀, vii.1978, 1 ♂, xii.1979 (*Janzen*) (TC); 3 ♂, 5 ♀, same locality, iii.1981, viii, xi-xii.1982, iv.1983 (*Janzen & Hallwachs*) (BMNH); 2 ♀, Volcán Cacao, Finca La Luz [Estacion Mengo], 1100 m, i, iii.1987 (*Janzen & Hallwachs*) (BMNH); 2 ♀, Volcán Orosi, Casa Mariksa [= Maritza], 800 m, v-vi.1986 (*Gauld*) (BMNH): Heredia Prov.: 1 ♂, Finca La Selva, 3 km S. Puerto Viejo, vi.1986 (*Hespenheide*) (BMNH): Puntarenas Prov.: 1 ♀, Monteverde, 1350 m, viii.1985 (*Haber*) (BMNH). **Ecuador**: 1 ♀, San Mateo, Esmeraldas, vi.1956 (*Foerster*) (CNC). **El Salvador**: 1 ♀, 10 km W. Quezaltepeque, viii.1963 (*Cavagnaro & Irwin*) (CAS). **Mexico**: Chiapas: 1 ♀, 3 km N. Huixtla, 750 m, vi.1969 (*Mason*) (CNC); 1 ♀, Muste, nr. Huixtla, 440 m, viii.1970 (CNC). **Panama**: 1 ♂, 2 ♀, Las Cumbres, v-vii.1982 (*Wolda*) (TC). **Venezuela**: 1 ♂, 1 ♀, Antimano, 950 m, vi.1938, vi.1939 (*Berthier*) (TC); 3 ♀, nr Caracas, x.1938, 1942 (TC); 1 ♂, Caripito, vii.1947 (*Anduze*) (TC); 1 ♂, El Encanto, Mir., v.1939 (*Lopez*) (TC); 1 ♀, Tucuco, Zulia, iv.1981 (*Townes*) (TC).

***Enicospilus guatemalensis* (Cameron)**

(Fig. 271)

Ophion (*Enicospilus*) *guatemalensis* Cameron, 1886: 293. Holotype ♂ [not ♀ as stated in description], GUATEMALA (BMNH) [examined].
Henicospilus guatemalensis (Cameron) Dalla Torre, 1901: 182.
Enicospilus guatemalensis (Cameron) Hooker, 1912: 68.

Description. Mandibles quite long, proximally quite strongly narrowed, distally more or less parallel-sided, apically twisted 30–45°; upper mandibular tooth slightly compressed, 1.6–1.9 times as long as the lower tooth; outer mandibular surface sparsely pubescent, centrally slightly convex, with a very weak proximal concavity. Labrum 0.2–0.4 times as long as broad; malar space 0.3–0.4 times as long as basal mandibular width. Clypeus in profile almost flat, margin rather acute, not impressed; clypeus in front view 1.2–1.4 times as broad as long, with margin weakly convex apically. Lower face 0.65–0.75 times as broad as long, polished, with fine punctures. Head in dorsal view with genae strongly narrowed behind eyes; posterior ocellus very close to eye; FI = 60–70%; occipital carina mediodorsally complete, ventrally curved to join hypostomal carina about 0.6–0.8 times the basal mandibular width away from mandible. Antenna long but quite stout, with 55–60 flagellar segments; 20th segment 1.6–2.0 times as long as broad.

Mesoscutum polished with shallow close punctures, in profile evenly rounded; notauli vestigial. Mesopleuron weakly to strongly polished, the upper part sparsely and finely punctate, the lower part with transverse wrinkles; epicnemial carina inclined towards anterior margin of pleuron. Scutellum in profile moderately convex, laterally carinate for all of its length; scutellum in dorsal view 1.5–1.6 times as long as anteriorly broad, smooth or irregularly wrinkled. Metapleuron moderately convex, punctostriate to striate or slightly rugose posterodorsally; submetapleural carina weakly and evenly anteriorly broadened; posterior transverse carina of mesosternum usually weak or indistinct centrally or absent either side of the mid line. Propodeum in profile abruptly declivous; anterior transverse carina more or less complete, posterior transverse carina absent or represented as lateral vestiges; anterior area quite short and deeply impressed, coriaceous-striate; spiracular area short, smooth; posterior area reticulately wrinkled; lateral longitudinal carina more or less complete, joined to spiracular margin by a short carina.

Fore wing length 12–16 mm; discosubmarginal cell as in Fig. 271; AI = 0.73–1.15; CI = 0.29–0.37; ICI = 0.38–0.53; SDI = 1.00–1.16; *cu-a* from subopposite to base of *Rs&M*, to proximal to it by up to 0.3 times its own length; marginal cell proximally slightly more sparsely hirsute; 1st subdiscal cell with distal end and anterior 0.6 hirsute. Hind wing with 6–8 hamuli on *R*1; 1st abscissa of *Rs* straight, 2nd abscissa weakly arcuate.

Fore leg with tibia subcylindrical, with fine scattered spines on outer surface. Mid leg with longer tibial spur 1.3–1.5 times length of the shorter. Hind leg with coxa in profile 1.7–1.8 times as long as deep; trochantellus dorsally 0.1 times as long as broad; 4th segment of tarsus 1.9–2.4 times as long as broad; claws of female with long close pectinae, those of male similar but with shorter pectinae.

Gaster long and slender; tergite 2 in profile at least 5 times as long as posteriorly deep, laterotergite turned under, thyridia elliptical and separated from anterior margin of tergite by about 3.5 or more times its own length. Ovipositor slender, its sheath narrow. Male with sternites 7–9 bearing scattered erect hairs; gonosquama evenly rounded.

Colour generally yellowish orange with or without darker marks as discussed below; interocellar area and antennae yellow; pterostigma orange; wings hyaline.

VARIATION. This species exists in two distinctive colour morphs. The widespread form (which includes the holotype) is uniformly yellowish orange, and slightly more robust, whilst there is an apparently conspecific form in Ecuador which is black-marked on the mesoscutum, mesopleuron and mesosternum, propodeum, mid and hind coxae, hind femur, posterior parts of tergites 1–2 and most of 3+. The dark form is slightly more slender, and tends to be more striately sculptured laterally than does the widespread form. Specimens from the Dominican Republic have dark mesoscutal vittae.

A relatively large (fore wing length 17 mm) female from the Dominican Republic is tentatively referred to this species. It differs from other specimens in that the alitrunk is dark reddish brown with large irregular pale yellowish markings. The alar pubescence is sparser and the distal sclerite is slightly broadened distally.

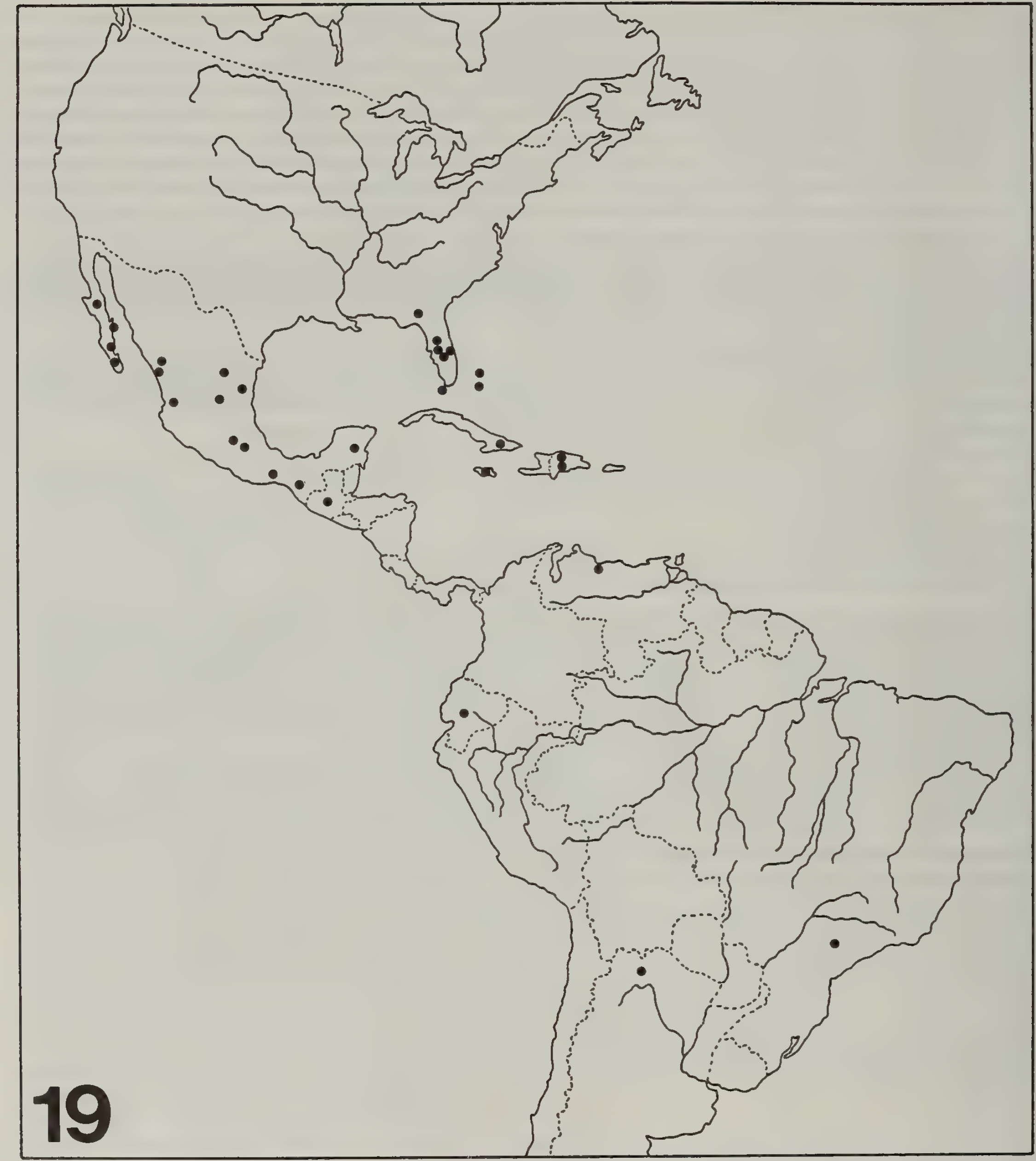
REMARKS. The long, large fenestra distinguishes *Enicospilus guatemalensis* from all other species that have a yellow interocellar area and lack a central sclerite. Its phylogenetic position is uncertain.

BIOLOGICAL INFORMATION. *Enicospilus guatemalensis* is an extremely widespread species whose range extends throughout Mexico, from about 26°N, south into Guatemala and from about 30°N in Florida southwards to the Bahamas and onto the older, larger Caribbean islands (Map 19). In South America it is known from Venezuela westwards into Ecuador and south to Argentina. Despite intensive collecting it has not been taken in either Costa Rica or Panama. Whether this indicates a real break in the distribution of this species, or whether it occurs in habitats so far not sampled only further collecting will reveal. *E. guatemalensis* has been collected from almost sea level up to 1700 m. It has often been collected in rather open forests, but in Florida it has been taken in suburban situations. No hosts are known for this species.

MATERIAL EXAMINED

Holotype ♂, **Guatemala**: San Geronimo (BMNH).

Argentina: 1 ♂, Yuto, xi.1966 (*Townes & Townes*) (TC). **Bahamas**: 1 ♂, Great Abaco, Simons Pt, i.1984 (*Teale*) (USNM); 2 ♂, 1 ♀, Man-o-War Cay, viii.1971 (*Howden*) (TC). **Brazil**: 1 ♀, Minas Gerais, Pedra Azul, 800 m, xi.1972 (*Alvarenga & Seabra*) (TC). **Cuba**: 1 ♀, Guantanamo Bay, ii.1965 (*Porter*) (FSCA). **Dominican Republic**: 1 ♂, Monte Cristi Prov., 10 km S. Monte Cristi, 5 m, v.1973 (*Davis & Davis*) (USNM); 2 ♀, San Lorenzo, v.1915 (USNM); 1 ♂, 1 ♀, Santiago, iii.1936 (*Rosario*) (MCZ); 2 ♀, Santiago, La Cumbre, 1000 m, vi.1978 (*Woodruff*) (FSCA). **Ecuador**: 4 ♀, Río León, 1700 m; iii.1965 (*Peña*) (TC). **Guatemala**: 1 ♀, San Geronimo (BMNH). **Jamaica**: 1 ♂, Trelawny Parish, Trelawny Beach Hotel, viii.1985 (*Eger*) (BMNH). **Mexico**: Baja California: 1 ♂, El Sargento, vi.1983 (*Stange & Miller*) (FSCA); 1 ♂, 8 km N. La Paz on highway 1, xii.1978 (*Weissman et al.*) (CAS); 1 ♀, 10 km N. Todos Santos, road to La Paz, xii.1958 (*Leech*) (CAS); 1 ♂, St Nicolas Bay, Gulf of California, v.1921 (*Chamberlin*) (CAS): Chiapas: 1 ♀, San Cristobal, 2000 m, v.1969 (*Teskey*) (CNC): Mexico State: 1 ♂, Cuernavaca, viii.1951 (*Hull*) (CNC): Morelos: 1 ♂, nr Tijalpa, vi.1963 (*Woodruff*) (FSCA): Nayarit: 1 ♀, Vic.



Map 19 Localities at which *Enicospilus guatemalensis* has been collected.

Compostela, vi.1934 (TC): Nuevo León: 1 ♀, 8 km S. Monterrey, vii.1963 (*Howden*) (BMNH): Oaxaca: 1 ♂, Ixtpec, viii.1939 (*Townes*) (TC): Quintana Roo: 1 ♂, X-can, viii.1963 (*Welling*) (CNC): San Luis Potosí: 1 ♀, 2 km W. Tamazanchale, viii.1972 (*Hevel & Hevel*) (USNM): Sinaloa: 2 ♀, Mazatlan, viii.1971 (*Davis*) (TC); 1 ♂, Mazatlan, vii.1939 (*Townes*) (TC); 1 ♀, 43 km E. Villa Union, vii.1964 (*Howden & Howden*) (CNC); 1 ♂, 45 km E. Villa Union, viii.1964 (*Martin*) (CNC): Tamulipas: 2 ♀, Ciudad Victoria, viii.1972 (*Hevel & Hevel*) (USNM). **U.S.A.**: Florida: 5 ♀, Alachua Co., Austin Cary Memorial Forest, iv-vii.1975 (*Fairchild*) (FSCA); 1 ♀, same locality and collector, iv.1982 (FSCA); 1 ♀, Alachua Co., Gainesville, iv.1971 (*Mead*) (FSCA); 2 ♀, same locality, iv.1975 (*Mead*) (FSCA); 1 ♀, same locality, xi.1975 (*Weems*) (FSCA); 1 ♂, Highlands Co., Archbold Biological Station, i.1962 (*Frost*) (TC); 1 ♀, Jackson Co., Florida Caverns State Park, xii.1951 (*Denmark*) (FSCA); 2 ♀, same locality, xii.1957 (*Weems*) (TC); 1 ♀, Marion Co., 14 km SSW. Ocala, Kingslane Country Est., x.1975 (*Wiley*) (FSCA); 1 ♀, Monroe Co., Bahia Honda State Park, vii.1973 (*Woodruff*) (FSCA); 1 ♀, Seminole Co., Longwood, ii.1975 (*Mason*) (CNC). **Venezuela**: 1 ♀, Aragua, Rancho Grande, iii-iv.1960 (*Test*) (UM).

Enicospilus karrensis sp. n.

(Figs 179, 272)

DESCRIPTION. Mandibles rather short, proximally strongly narrowed, apically twisted 10–20°; upper mandibular tooth subtriangular, 1.4–1.7 times as long as the lower tooth; outer mandibular surface sparsely punctate, concave, this concave area often slightly coriaceous. Labrum 0.3 times as long as broad; malar space 0.2–0.3 times as long as basal mandibular width. Clypeus in profile slightly out-flared, margin blunt; clypeus in front view 1.5–1.9 times as broad as long with apical margin truncate to slightly concave (Fig. 179). Lower face 0.70–0.75 times as broad as long, polished, with sparse fine punctures. Head in dorsal view with genae constricted behind the eyes; posterior ocellus contiguous with eye; FI = 55–60%; occipital carina mediodorsally complete, ventrally curved to join hypostomal carina about 0.6–0.7 times the basal mandibular width away from mandible. Antenna moderately long and slender, with 49–53 flagellar segments; 20th segment 1.8–2.0 times as long as broad.

Mesoscutum in profile abruptly rounded; notauli absent. Mesopleuron polished, the upper part with rather coarse but shallow punctures, the lower part punctate or punctostriate; epicnemial carina curved towards but generally not reaching anterior margin of pleuron. Scutellum in profile weakly convex, strongly laterally carinate for all of its length; scutellum in dorsal view 1.5–1.6 times as long as anteriorly broad, polished. Metapleuron centrally punctate tending to punctostriate peripherally; submetapleural carina evenly broadened anteriorly; posterior transverse carina of mesosternum centrally broadly incomplete, at most represented by a weak wrinkle. Propodeum in profile abruptly declivous; anterior transverse carina complete, posterior transverse carina absent; anterior area steep, weakly coriaceous; spiracular area moderately long, smooth; posterior area finely coriaceous; lateral longitudinal carina complete, not joined to spiracular margin by a short carina.

Fore wing length 10–12 mm; discosubmarginal cell as in Fig. 272; AI = 1.35–2.07; CI = 0.20–0.25; ICI = 0.25–0.35; SDI = 1.10–1.15; *cu-a* slightly proximal to *Rs&M*; marginal cell proximally very sparsely pubescent; 1st subdiscal cell with scattered hairs distally. Hind wing with 5–6 hamuli on *R*1; 1st abscissa of *Rs* straight, 2nd abscissa weakly arcuate.

Fore leg with tibia subcylindrical, with scattered spines on outer surface. Mid leg with longer tibial spur 1.7 times length of the shorter. Hind leg with coxa in profile 1.7–1.8 times as long as deep; trochantellus dorsally 0.1 times as long as broad; 4th segment of tarsus 1.9–2.1 times as long as broad; claws of female quite long, apically evenly curved, with short close pectinae; claws of male similar, but with pectinae finer.

Gaster slender; tergite 2 in profile 4–5 times as long as posteriorly deep, laterotergite turned under, thyridia elliptical and separated from anterior margin of tergite by about 4 times its own length. Ovipositor moderately slender, its sheath moderately slender. Male with sternites 7–9 bearing long, sparse, erect pubescence amid short, decumbent pubescence; gonosquama obliquely truncate.

Colour generally pale yellow, mesoscutum with three dark longitudinal vittae and mesoscutum with a weak to strongly developed brownish mark along upper hind margin; tergites 5+ of gaster infuscate; interocellar area usually yellow, rarely with infuscation between hind ocelli; antennae golden; pterostigma orange; wings hyaline.

VARIATION. Morphologically this is a very uniform species.

REMARKS. This species is named in honour of James Karr in recognition of his contribution to the understanding of rain forest bird biology.

Enicospilus karrensis is easily distinguishable by the incomplete posterior transverse mesosternal carina, by the form of the clypeus and mandibles, and the pattern of the alar sclerite. The form of the mouthparts of this species bears some superficial similarity to the Old World species *E. sesamiae* Delobel and *E. sakaguchii* (Matsumura & Uchida). However, the Old World species have the clypeal margin thin and the mandibles diagonally grooved suggesting there is no real phylogenetic affinity between these three species. The concave clypeus and short mandibles of *E. karrensis* are probably a parallel adaptation for dealing with a similar type of host. The Old World species parasitize grass-feeding noctuids (Moutia, 1934; Nagatomi, 1972), but the host of *E. karrensis* is not known.

BIOLOGICAL INFORMATION. *Enicospilus karrensis* has only been collected in lowland forest in Central Panama, but at this locality is is one of the commoner species of *Enicospilus* in light-trap samples. Its pooled seasonal distributional data (1983–5) on Barro Colorado Island are:

J	F	M	A	M	J	J	A	S	O	N	D
–	–	–	5	6	3	9	2	4	–	1	–

Its host is unknown.

MATERIAL EXAMINED

Holotype ♂, **Panama**: Barro Colorado Island, 120 m, vi.1984 (*Wolda*) (BMNH).

Panama: 2 ♂, 4 ♀, Barro Colorado Island, Gatun Lake, iv.1979, xi.1982, iv-v.1983 (*Wolda*) (TC); 10 ♂, 14 ♀, Barro Colorado Island, 120 m, v-ix, xi.1983–85 (*Wolda*) (BMNH; CNC).

Enicospilus stevensi sp. n.

(Figs 111, 180, 273)

DESCRIPTION. Mandibles moderately long, fairly evenly narrowed, apically twisted about 80°; upper mandibular tooth subcylindrical, 1.4–1.6 times as long as the slightly compressed and slightly broader lower tooth (Fig. 180); outer mandibular surface flat, with a weak proximal concavity. Labrum 0.2 times as long as broad; malar space 0.2 times as long as basal mandibular width. Clypeus in profile flat, margin rather blunt; clypeus in front view 1.4–1.5 times as broad as long, with its margin apically truncate. Lower face 0.70–0.75 times as broad as long, finely punctate. Head in dorsal view with genae rounded behind the eyes; posterior ocellus contiguous with eye; FI = 70%; occipital carina mediodorsally complete, ventrally curved to join hypostomal carina about 0.5–0.8 times the basal mandibular width away from mandible. Antenna long, relatively slender, with 61–63 flagellar segments; 20th segment 2.1–2.2 times as long as broad.

Mesoscutum polished, without obvious punctures, in profile evenly rounded; notauli weak. Mesopleuron polished, the upper part weakly and sparsely punctate, ventrally becoming more closely punctate or punctostriate, and with the lower part punctostriate to striate; epicnemial carina curved towards anterior margin of pleuron. Scutellum in profile moderately convex, laterally carinate for most of its length; scutellum in dorsal view 1.5–1.6 times as long as anteriorly broad, punctate, posteriorly wrinkled. Metapleuron very convex, rugose-striate; submetapleural carina evenly anteriorly broadened; posterior transverse carina of mesosternum complete or narrowly interrupted centrally. Propodeum in profile abruptly declivous, dorsally very strongly flattened; anterior transverse carina complete, posterior transverse carina represented laterally by a pair of anteriorly directed ridges; anterior area steep, quite long, striate; spiracular area moderately long, finely punctate; posterior area coarsely irregularly reticulate; lateral longitudinal carina present on anterior 0.6, joined to spiracular margin by a short carina.

Fore wing length 19–22 mm; discosubmarginal cell as in Fig. 273; AI = 1.00–1.05; CI = 0.19–0.34; ICI = 0.56–0.58; SDI = 1.05–1.09; *cu-a* proximal to base of *Rs&M* by 0.4–0.7 times its own length; marginal cell proximally with a small glabrous area adjacent to *Rs+2r* opposite proximal sclerite; 1st subdiscal cell with anterior and distal margins hirsute. Hind wing with 8–10 hamuli on *R*1; 1st abscissa of *Rs* straight, 2nd abscissa very weakly arcuate.

Fore leg with tibia subcylindrical, with scattered spines on outer surface. Mid leg with longer tibial spur 1.4–1.5 times length of the shorter. Hind leg with coxa in profile 1.7 times as long as deep; trochantellus dorsally 0.1 times as long as broad; 4th segment of tarsus 2.2–2.3 times as long as broad; claws of female stout, abruptly curved, bearing long, close pectinae; those of male similar but with pectinae finer.

Gaster long and slender; tergite 2 in profile 6 times as long as posteriorly deep, laterotergite turned under, thyridia obovate and separated from anterior margin of tergite by about 4 times its own length. Ovipositor slender, its sheath exceptionally broad (Fig. 111). Male with sternites 7–9 bearing long erect hairs; gonosquama distally bluntly rounded.

Colour generally brownish orange; interocellar area yellow; antennae blackish; mesoscutal vittae blackish. Gaster paler yellowish brown, with tergites 5+ blackish and often with posterior margin of tergite 2 slightly infuscate; pterostigma orange; wings almost hyaline.

VARIATION. The specimens from Bolivia are very similar to the Costa Rican specimens but have the meso- and metapleurae more regularly punctate.

REMARKS. This species is named in honour of George Stevens for his tireless activity on behalf of dry forest research in Santa Rosa National Park.

Enicospilus stevensi can be recognized by the following combination of features: absence of any central sclerite; having a strongly twisted mandible; possessing an exceptionally convex metapleuron; having the very broad ovipositor sheath. The relatively small value of ICI is unusual in a species of this size and the colour pattern of the gaster is also quite unusual and characteristic. In the venation, form of the mandible, sculpture and shape of the metapleuron *E. stevensi* is very similar to *E. pamelae*. Females of the two species can easily be distinguished by the shape of the ovipositor sheath (that of *E. pamelae* is slender). The male of *E. pamelae* is unknown so I cannot yet give features for distinguishing it from males of *E. stevensi*.

BIOLOGICAL INFORMATION. *Enicospilus stevensi* is a very widely distributed Neotropical species whose range extends from Chiapas in southern Mexico, south to Bolivia. However, it is relatively rarely captured, and despite extensive collecting in Costa Rica only three individuals have been caught. Two of these were taken in Santa Rosa National Park during the wet season. Nothing is known of the hosts of this species.

MATERIAL EXAMINED

Holotype ♂, **Costa Rica**: Guanacaste Prov., Santa Rosa National Park, 300 m, viii.1984 (*Janzen & Hallwachs*) (BMNH).

Paratypes. **Bolivia**: 1 ♀, Chapare, El Limbo, 2200 m, i.1962 (BMNH); 1 ♀, Santa Cruz, Ingenio la Belgica, 38 km N. Santa Cruz, i.1980, (*Stange*) (FSCA). **Costa Rica**: Guanacaste Prov.: 1 ♂, Santa Rosa National Park, 300 m, vi.1980 (*Janzen & Hallwachs*) (BMNH): San José Prov.: 1 ♀, Estacion Carrillo, Braulio Carrillo National Park, 700 m, iv.1985 (*Chacon*) (BMNH). **Mexico**: Chiapas: 1 ♂, 30–40 km N. Huixtla, 1000 m, vi.1969 (*Peterson*) (CNC).

Enicospilus pamelae sp. n.

(Figs 110, 274)

DESCRIPTION. Mandibles of moderate length, evenly narrowed, apically twisted 80°; upper mandibular tooth compressed, very acute, 1.4–1.7 times as long as the lower tooth; outer mandibular surface sparsely pubescent, flat with a broad, shallow proximal concavity. Labrum 0.1–0.2 times as long as broad; malar space 0.3 times as long as basal mandibular width. Clypeus in profile flat, margin subacute; clypeus in front view 1.2–1.4 times as broad as long, its apex virtually truncate. Lower face 0.63–0.70 times as broad as long, centrally with very sparse fine punctures. Head in dorsal view with genae evenly constricted behind eye; posterior ocellus contiguous with eye; FI = 65–70%; occipital carina mediodorsally complete, ventrally curved to join hypostomal carina about 0.8–0.9 times the basal mandibular width away from mandible. Antenna long and slender, with 59–61 flagellar segments; 20th segment 1.9–2.1 times as long as broad.

Mesoscutum polished and sparsely punctate, in profile evenly rounded; notauli vestigial. Mesopleuron polished, the upper part finely punctate, the lower part punctate with weak longitudinal wrinkling; epicnemial carina curved towards anterior margin of pleuron, its upper end evanescent. Scutellum in profile moderately convex, laterally carinate for all of its length; scutellum in dorsal view 1.6 times as long as anteriorly broad, smooth with scattered punctures, and posteriorly with a few weak wrinkles. Metapleuron strongly convex, with diagonal wrinkling anterodorsally; submetapleural carina weakly broadened anteriorly; posterior transverse carina of mesosternum complete. Propodeum in profile quite abruptly declivous, flattened; anterior transverse carina complete, posterior one present as a lateral vestige that forms a sharp crest laterally on the posterior area; anterior area deeply excavate, sparsely striate; spiracular area short, smooth; posterior area coarsely irregularly reticulate; lateral longitudinal carina generally complete, joined to spiracular margin by a short carina.

Fore wing length 14–16 mm; discosubmarginal cell as in Fig. 274; AI = 0.73–0.93; CI = 0.30–0.33; ICI = 0.41–0.68; SDI = 1.10–1.19; *cu-a* proximal to the base of *Rs&M* by 0.1–0.3 times its own length; marginal cell proximally slightly more sparsely hirsute proximally; 1st subdiscal cell with distal part sparsely hirsute. Hind wing with 6–8 hamuli on *R*1; 1st abscissa of *Rs* straight, 2nd abscissa weakly bowed.

Fore leg with tibia subcylindrical, with fine scattered spines on outer surface. Mid leg with longer tibial spur 1.4–1.5 times length of the shorter. Hind leg with coxa in profile 1.9–2.0 times as long as deep; trochantellus dorsally 0.1 times as long as broad; 4th segment of tarsus 2.5 times as long as broad; claws of female large, strongly curved and with short close pectinae.

Gaster slender; tergite 2 in profile more than 5 times as long as posteriorly deep, laterotergite folded under, thyridia elliptical and separated from anterior margin of tergite by about 4 times its own length. Ovipositor slender, its sheath narrow (Fig. 110). Male unknown.

Colour generally pale yellowish, with legs golden and anterior gastral segments orange; tergite 3+ infuscate; mesoscutum anteriorly slightly darker; interocellar area pale yellow; antenna proximally black, distally brown; pterostigma yellow brown; wings weakly infumate.

VARIATION. The smaller specimens have weaker striation on the thorax laterally and only have the scape blackish.

In the Townes' collection is a female from Bolivia which resembles this species except that it is altogether paler. The propodeal sculpture of this specimen is finer and it is not clear whether or not it is truly conspecific so I have excluded it from the paratype series.

REMARKS. This species is named in honour of Pamela Mitchell, as a gesture of thanks for all her help in sorting 36 Malaise trap-years of samples.

Enicospilus pamelae resembles *E. stevensi* in the form of the mandibles, alar sclerites, venation and form of the metapleuron, but differs in several features emphasized in the key. *E. stevensi* is altogether larger and more robust; it has the area of the fore wing anterior to the proximal sclerite fairly evenly hirsute so there is only a narrow anterior extension of the fenestra, whilst *E. pamelae* has a very broad anterior fenestral extension.

BIOLOGICAL INFORMATION. In Mesoamerica *Enicospilus pamelae* is only known from lowland rainforest on Barro Colorado Island where occasional specimens have been collected between May and July. Nothing is known of its hosts.

MATERIAL EXAMINED

Holotype ♀, **Panama**: Barro Colorado Island, 120 m, v.1985 (*Wolda*) (BMNH).
Paratypes. **Panama**: 4 ♀, Barro Colorado Island, 120 m, v-vii.1984–5 (*Wolda*) (BMNH).
Non-paratypic material. **Bolivia**: 1 ♀, Santa Cruz, Buena Vista, iv.1950 (*Peña*) (TC).

Enicospilus vilmari sp. n.

(Fig. 276)

DESCRIPTION. Mandibles quite short, strongly narrowed and with a ventrobasal lobe, apically twisted 30°; upper mandibular tooth depressed, 1.4 times as long as the lower; outer mandibular surface flat, sparsely pubescent. Labrum 0.2 times as long as broad; malar space 0.4 times as long as basal mandibular width. Clypeus in profile very weakly convex, margin blunt; clypeus in front view 1.3 times as broad as long, its margin weakly convex. Lower face 0.7 times as broad as long, polished, with shallow punctostriations centrally. Head in dorsal view with genae abruptly constricted; posterior ocellus close to eye; FI = 65%; occipital carina mediodorsally complete, ventrally curved to join hypostomal carina about 1.0 times the basal mandibular width away from mandible. Antenna long and slender, with 56 flagellar segments; 20th segment 2.5 times as long as broad.

Mesoscutum polished, sparsely but distinctly punctate, in profile evenly rounded; notauli vestigial. Mesopleuron polished, the upper part punctate, the lower part punctate but centrally tending to punctostriate; epicnemial carina inclined towards anterior margin of pleuron. Scutellum in profile weakly convex, laterally carinate for all of its length; scutellum in dorsal view 1.5 times as long as anteriorly broad, anteriorly smooth, posteriorly with a few striae. Metapleuron moderately convex, diagonally striate; submetapleural carina strongly anteriorly broadened; posterior transverse carina of mesosternum complete. Propodeum in profile evenly declivous; anterior transverse carina complete, posterior transverse carina absent; anterior area deeply excavate, striate; spiracular area short, smooth; posterior area reticulate laterally, centrally tending to concentrically rugose; lateral longitudinal carina present anteriorly, joined to spiracular margin by a short carina.

Fore wing length 14 mm; discosubmarginal cell as in Fig. 276; AI = 1.17; CI = 0.23; ICI = 0.44 SDI = 1.09; *cu-a* proximal to the base of *Rs&M* by about 0.1 times its own length; marginal cell proximally sparsely pubescent; 1st subdiscal cell with anterior and distal parts sparsely hirsute. Hind wing with 7 hamuli on *R*1; 1st abscissa of *Rs* straight, 2nd abscissa weakly curved.

Fore leg with tibia slightly flattened, with long slender spines on outer surface. Mid leg with longer tibial spur 1.7 times length of the shorter. Hind leg with coxa in profile 1.9 times as long as deep; trochantellus dorsally 0.1 times as long as broad; 4th segment of tarsus 2.5 times as long as broad; claws of female long, apically evenly curved with long stout pectinae.

Gaster long and slender; tergite 2 in profile 7 times as long as posteriorly deep, laterotergite folded under, thyridia elliptical and separated from anterior margin of tergite by about 4 times its own length. Ovipositor laterally compressed, rather stout, its sheath moderately broad. Male unknown.

Colour generally yellowish, mesoscutal vittae blackish and tergites 3+ of gaster infuscate; interocellar area yellow; antenna black; pterostigma brown; wings hyaline.

REMARKS. This species is named in honour of Vilmar Rodriguez in recognition of his tireless efforts at protecting Cerro el Hacha, Guanacaste National Park, from fire.

Enicospilus vilmari may easily be distinguished from all other Mesoamerican species by the form of the proximal alar sclerite (Fig. 276) which is rather elongately tapered distally.

BIOLOGICAL INFORMATION. *Enicospilus vilmari* is only known to occur in north-western Costa Rica where a single individual has been collected in dry forest during the dry season. It is not known what hosts this species parasitizes.

MATERIAL EXAMINED

Holotype ♀, **Costa Rica**: Guanacaste Prov., Santa Rosa National Park, 300 m, ii.1982 (*Janzen & Hallwachs*) (BMNH).

Enicospilus estradarum **sp. n.**

(Fig. 277)

DESCRIPTION. Mandibles moderately long, evenly narrowed, very weakly curved, apically twisted 20°; upper mandibular tooth slender, 1.5 times as long as the lower tooth; outer mandibular surface sparsely pubescent, distally flat, but with a weak proximal concavity. Labrum 0.3 times as long as broad; malar space 0.3 times as long as basal mandibular width. Clypeus in profile weakly convex, margin blunt; clypeus in front view 1.3–1.4 times as broad as long, the margin weakly convex. Lower face 0.73–0.76 times as broad as long, polished, sparsely punctate. Head in dorsal view with genae evenly narrowed; posterior ocellus contiguous with eye; FI = 62%; occipital carina mediodorsally complete, ventrally curved to join hypostomal carina about 0.6 times the basal mandibular width away from mandible. Antenna long and slender, with 56 flagellar segments; 20th segment 2.4 times as long as broad.

Mesoscutum polished, finely punctate, in profile evenly rounded; notauli vestigial. Mesopleuron polished, the upper and lower parts finely punctate; epicnemial carina curved towards anterior margin of pleuron. Scutellum in profile moderately convex, laterally carinate for 0.6 of its length; scutellum in dorsal view 1.6 times as long as anteriorly broad, smooth, posteriorly wrinkled. Metapleuron convex punctate; submetapleural carina weakly broadened anteriorly; posterior transverse carina of mesosternum complete. Propodeum in profile evenly rounded; anterior transverse carina complete, posterior transverse carina represented laterally by a weak to vestigial crest; anterior area quite long, striate; spiracular area finely punctate; posterior area reticulate; lateral longitudinal carina present on anterior 0.4, joined to spiracular margin by a short, very weak carina.

Fore wing length 16–17 mm; discosubmarginal cell as in Fig. 277; AI = 0.60–0.80; CI = 0.30–0.32; ICI = 0.48–0.55; SDI = 1.11–1.16; *cu-a* slightly proximal to the base of *Rs&M*; marginal cell proximally more or less evenly hirsute; 1st subdiscal cell with anterior and distal periphery hirsute. Hind wing with 7 hamuli on *R*1; 1st abscissa of *Rs* straight, 2nd abscissa weakly curved.

Fore leg with tibia weakly flattened, with scattered spines on outer surface. Mid leg with longer tibial spur 1.2–1.3 times length of the shorter. Hind leg with coxa in profile 1.7 times as long as deep; trochantellus dorsally 0.1 times as long as broad; 4th segment of tarsus missing; claws of male missing.

Gaster slender; tergite 2 in profile 6 times as long as posteriorly deep, laterotergite turned under, thyridia elliptical and separated from anterior margin of tergite by about 3.5 times its own length. Female unknown. Male with sternites 7–9 bearing long, dense, erect pubescence; gonosquama evenly rounded.

Colour generally yellowish orange; interocellar area yellow; antennae blackish; terminal segments of gaster slightly infuscate; pterostigma orange; wings hyaline.

VARIATION. None remarkable.

REMARKS. This species is named in honour of Rosy and Alejandro Estrada for their efforts in biology at the Los Tuxtlas Biology Station, Mexico.

The mandibles of *Enicospilus estradarum* are rather different from those of any other species that lacks a central sclerite in that they are slightly broader and angled downwards. This difference is rather difficult to appreciate unless reference can be made to several species. *E. estradarum* is most easily distinguished from other Mesoamerican species of *Enicospilus* by the presence of a band of hairs in the discosubmarginal cell close to the base of *Rs+2r*; these hairs are bounded proximally by an extension of the fenestra (Fig. 277).

BIOLOGICAL INFORMATION. *Enicospilus estradarum* is only known to occur in Costa Rica where it has been collected in the seasonally dry forests in Santa Rosa National Park. Despite extensive collecting only two specimens have been taken, in June and July, at the start of the wet season. Nothing is known of the hosts of this species.

MATERIAL EXAMINED

Holotype ♂, **Costa Rica**: Guanacaste Prov., Santa Rosa National Park, 300 m, vii.1980 (*Janzen & Hallwachs*) (TC).

Paratype. **Costa Rica**: Guanacaste Prov.: 1 ♂, Santa Rosa National Park, 300 m, vi.1982 (*Janzen & Hallwachs*) (BMNH).

Enicospilus teodorae sp. n.

(Figs 116, 279)

DESCRIPTION. Mandibles quite long, proximally weakly narrowed, distally almost parallel-sided and apically twisted 10°; upper mandibular tooth compressed, 0.8–0.9 times as long as the lower tooth; outer mandibular surface almost flat, bearing long scattered hairs. Labrum 0.3–0.4 times as long as broad; malar space 0.3–0.4 times as long as basal mandibular width. Clypeus in profile nasute, margin blunt (Fig. 116); clypeus in front view 1.1–1.2 times as broad as long, with margin slightly V-shaped. Lower face 0.6–0.7 times as broad as long, polished, obsoletely punctostriate. Head in dorsal view with genae strongly constricted behind eyes; posterior ocellus very close to eye; FI = 60–65%; occipital carina mediodorsally complete, ventrally joining hypostomal carina about 0.8 times the basal mandibular width away from mandible. Antenna exceedingly long and slender, with 60–65 flagellar segments; 20th segment 2.9–3.0 times as long as broad.

Mesoscutum weakly polished, with scattered weak punctures, in profile evenly rounded; notauli absent. Mesopleuron polished, the upper part centrally smooth, the lower part punctostriate to striate; epicnemial carina evenly curved towards, but usually not quite reaching anterior margin of pleuron. Scutellum in profile evenly rounded, laterally carinate for all of its length; scutellum in dorsal view 1.2–1.3 times as long as anteriorly broad, anteriorly finely punctate, posteriorly striate. Metapleuron moderately convex, with obsolescent fine scattered punctures, generally rather smooth and shining; submetapleural carina narrow, barely broadened anteriorly; posterior transverse carina of mesosternum complete. Propodeum in profile evenly declivous; anterior transverse carina complete, posterior transverse carina absent; anterior area weakly impressed, centrally striate; spiracular area long, smooth; posterior area transversely striate to irregularly wrinkled; lateral longitudinal carina complete, joined to spiracular margin by a short carina, or sometimes with this carina discontinuous.

Fore wing length 12–13 mm; discosubmarginal cell as in Fig. 279; AI = 1.43–2.05; CI = 0.17–0.29; ICI = 0.34–0.40; SDI = 1.12–1.19; *cu-a* opposite or very slightly distal to the base of *Rs&M*; marginal cell proximally broadly glabrous, or with isolated hairs; 1st subdiscal cell rather sparsely hirsute, except near proximal end which is glabrous. Hind wing with 5–6 hamuli on *R*1; 1st abscissa of *Rs* straight, 2nd abscissa very slightly arcuate.

Fore leg with tibia weakly flattened, without spines on outer surface. Mid leg with longer tibial spur 1.6 times length of the shorter. Hind leg with coxa in profile 1.9–2.0 times as long as deep; trochantellus dorsally 0.4–0.5 times as long as broad; 4th segment of tarsus 2.3–2.4 times as long as broad; claws of female symmetrical, long, with short, fairly closely spaced pectinae; claws of male similar but with pectinae slightly shorter.

Gaster slender; tergite 2 in profile more than 7 times as long as posteriorly deep, laterotergite up-turned, thyridia elliptical and separated from anterior margin of tergite by about 5.0 times its own length. Ovipositor apically quite slender, its sheath narrow. Male with sternites 7–9 bearing fine semierect pubescence that is longer, closer and more erect mediolongitudinally; gonosquama evenly rounded.

Colour generally pale yellow; interocellar area and three mesoscutal vittae black; antennae brownish, distally infuscate, scape often blackish; mesosternum dark brown; legs golden; terminal segments of gaster slightly infuscate, tergite 3 very pale; pterostigma brownish yellow; wings hyaline.

VARIATION. The holotype female from Panama has the alitrunk extensively black-marked and the gaster uniformly brown. Structurally it is otherwise very like the paratypes.

REMARKS. This species is named in honour of Teodora Rodriguez for her courageous stand against threats to Cerro el Hacha, Guanacaste National Park.

Enicospilus teodorae is easily recognized by the peculiar form of the clypeus. The axis of the mandible is twisted slightly forwards so the mandibles open outwards as well as downwards. The function of these modifications to the mouthparts is not known. The phylogenetic relationships of this species are not clear even though the clypeus of *E. teodorae* resembles that of *E. bima* (see that species). As these two taxa do not share any other morphological specializations I do not think they are closely related.

BIOLOGICAL INFORMATION. *Enicospilus teodorae* is a widely distributed, but rarely collected species, whose range extends from Central Panama south throughout lowland South America to the tropic of Capricorn.

The extremely elongate antennae suggest that this species may fly in the canopy of forests. Its hosts are unknown.

MATERIAL EXAMINED

Holotype ♀, **Panama**: Las Cumbres, iv-v.1982 (*Wolda*) (TC).

Paratypes. **Brazil**: 1 ♂, Goias, Jatai, xi.1971 (*Oliveira*) (TC); 1 ♂, Rio de Janeiro, Mangaratiba, Muriqui, vii.1969 (*Alvarenga*) (TC); 5 ♀, Represa, Río Grande, Guanabara, ii.1967, ii-iii.1968, iii.1970 & iii.1972 (*Alvarenga*) (BMNH; TC). **Surinam**: 1 ♂, Paramaribo, Lelydorp, iii.1964 (*Geijskes*) (TC).

Enicospilus maritzai sp. n.

(Figs 112, 216, 280)

DESCRIPTION. Mandibles moderately long, evenly narrowed, apically twisted 70–80°; upper mandibular tooth slightly compressed, 1.4–1.8 times as long as the lower tooth which is rather more strongly compressed; outer mandibular surface sparsely pubescent, more or less flat. Labrum 0.3–0.4 times as long as broad; malar space 0.2–0.3 times as long as basal mandibular width. Clypeus in profile weakly convex, margin blunt; clypeus in front view 1.25–1.45 times as broad as long, its apical margin virtually truncate. Lower face 0.55–0.65 times as broad as long, submatt, finely but closely punctate, centrally tending to punctostriate. Head in dorsal view with genae constricted behind the eyes; posterior ocellus contiguous with eye; FI = 80–90%; occipital carina mediodorsally complete, ventrally curved to join hypostomal carina about 0.7 times the basal mandibular width away from mandible. Antenna long but relatively stout, with 63–65 flagellar segments; 20th segment 1.4–1.5 times as long as broad.

Mesoscutum weakly polished, with fine punctures, in profile fairly abruptly rounded; notauli quite long but very weakly impressed. Mesopleuron polished, the upper part finely punctate, the lower part punctostriate; epicnemial carina inclined towards anterior margin of pleuron. Scutellum in profile weakly convex, laterally carinate for all of its length; scutellum in dorsal view 1.5–1.6 times as long as anteriorly broad, polished, smooth with wrinkles posteriorly. Metapleuron strongly convex, finely punctate, posterodorsally coarsely strigose to reticulate; submetapleural carina anteriorly strongly broadened; posterior transverse carina of mesosternum broadly incomplete centrally. Propodeum in profile abruptly declivous; anterior transverse carina complete, posterior transverse carina strong, stretching from near hind coxa forwards to near centre of anterior transverse carina; anterior area strongly impressed, striate; spiracular area quite short, finely punctogranulate; posterior area usually centrally irregularly rugose to reticulate, laterally strigose-reticulate; lateral longitudinal carina present only as a vestige anteriorly, joined to spiracular margin by a short carina.

Fore wing length 20–23 mm; discosubmarginal cell as in Fig. 280; AI = 0.65–0.92; CI = 0.25–0.30; ICI = 0.78–0.88; SDI = 1.14–1.27; *cu-a* slightly proximal to the base of *Rs&M*; marginal cell proximally evenly hirsute; 1st subdiscal cell with anterior 0.5 hirsute. Hind wing with 9–10 hamuli on *R*1; 1st abscissa of *Rs* more or less straight, 2nd abscissa weakly arcuate.

Fore leg with tibia slightly flattened, with scattered spines on outer surface. Mid leg with longer tibial spur 1.1–1.3 times length of the shorter. Hind leg with coxa in profile 1.7–1.8 times as long as deep; trochantellus dorsally 0.1 times as long as broad; 4th segment of tarsus 2.2–2.3 times as long as broad; claws of female large and apically abruptly curved, with long fine pectinae, the central ones more widely interspaced than the distal or proximal ones (Fig. 216); claws of male similar but with pectinae shorter.

Gaster quite stout (Fig. 112); tergite 2 in profile 2.8–3.5 times as long as posteriorly deep, laterotergite folded under, thyridia subcircular to oval and separated from anterior margin of tergite by at least 3 times its own length. Ovipositor quite stout, its sheath slightly broadened. Males with sternites 7–9 bearing a dense covering of long stout erect hairs; gonosquama evenly rounded apically.

Colour generally brownish orange with tergites 3+ blackish; mesoscutum usually uniformly reddish brown, sometimes with a medial anterior black mark; interocellar area and antenna blackish; pterostigma brown; wings weakly infumate.

VARIATION. Most specimens have tergites 3+ of the gaster uniformly black, but some Brazilian specimens have a small pale mark laterally on tergite 3. There is considerable variation in the sculpture of the posterior area of the propodeum. The posterior transverse carina is always strong laterally, but the area between may be almost smooth in a few individuals, though it is most usually reticulate or irregularly rugose. The Peruvian specimen has a well-developed median longitudinal ridge.

REMARKS. *Enicospilus maritzai* together with *E. exoticus* and *E. jesicae* form a closely knit species complex. The three are characterized by the several apomorphic features. They are the only species with a black interocellar area, central sclerite and a large ICI. All have a dorsally flattened propodeum with the posterior transverse carina represented laterally by at least two weak crests. Tergites 3+ of the gaster are generally black, though there is a tendency for pale markings to be present laterally on tergite 3 and sometimes 4. All species have the posterior transverse carina of the mesosternum broadly interrupted centrally, and lack most of the lateral carina of the propodeum.

E. maritzai differs from *E. exoticus* in possessing distinct alar sclerites and having more twisted mandibles. It is also larger, has stouter antennae and generally has a more coarsely sculptured propodeum than either *E. exoticus* or *E. jesicae*. The arrangement of pectinae on the tarsal claw of the female of *E. maritzai* (Fig. 216) is quite unlike that of either of the other two species (see Fig. 218).

Biological Information. *Enicospilus maritzai* is a widely distributed species whose range extends from northern Costa Rica (*ca* 11°N) south throughout South America to about 18°S in Bolivia. It is rather uncommon in Costa Rica. Only five specimens have been collected in Santa Rosa National Park, a male and a female in May at the start of the wet season, and two females and a male in December at the end of the wet season. Elsewhere in the country two specimens have been collected at light in cloud forest in Monteverde Reserve during February and March and a single female during May in forest on Volcán Orosi. Nothing is known of the host range of this species.

Material Examined

Holotype ♀, **Costa Rica**: Guanacaste Prov., Volcán Orosi, Casa Mariksa (= Maritza), 7–800 m, v.1986 (*Gauld*) (BMNH).

Paratypes. **Bolivia**: 1 ♀, Cochabamba, Alto Palmar, 1100 m, ix.1960 (*Walz*) (TC). **Brazil**: 16 ♀, Bahia, Encruzilhada, 960 m, xi.1972 & xi.1974 (*Alvarenga*) (TC). **Costa Rica**: Guanacaste Prov.: 1 ♂, 2 ♀, Santa Rosa National Park, 300 m, xii.1979 (*Janzen*) (TC); 1 ♂, 1 ♀, same locality, v.1980 (*Janzen & Hallwachs*) (BMNH): Puntarenas Prov.: 1 ♂, Monteverde, iii.1961 (*Palmer*) (TC); 1 ♀, Monteverde, ii.1986 (*Forsyth*) (CNC). **Peru**: 1 ♀, Cusco, Santa Isabel, Río Ceosnipata, xii.1951 (*Woytkowski*) (TC).

Enicospilus exoticus (Morley)

(Figs 92, 107, 218, 221, 281)

Ophiomorpha bicolor Szépligeti, 1905: 35. Holotype ♀, BRAZIL (TM) [examined]. [Junior secondary homonym of *Enicospilus bicolor* (Taschenberg, 1875).]

Henicospilus exoticus Morley, 1912: 36. Holotype ♀, BRAZIL (BMNH) [examined]. **Syn. n.**

Enicospilus dichromus Townes & Townes, 1966: 176. [Replacement name for *bicolor* Szépligeti.]

Enicospilus exoticus (Morley) Townes & Townes, 1966: 177.

Description. Mandibles moderately long, quite strongly but evenly narrowed, apically twisted 50–60°; upper mandibular tooth subcylindrical, 1.2–1.4 times as long as the lower tooth which is slightly compressed; outer mandibular surface sparsely pubescent, distally almost flat, proximally with a weak concave area. Labrum 0.3 times as long as broad; malar space 0.2–0.3 times as long as basal mandibular width. Clypeus in profile weakly convex, margin blunt; clypeus in front view 1.5–1.6 times as broad as long, with apical margin weakly convex. Lower face 0.6–0.7 times as broad as long, weakly polished, finely punctate. Head in dorsal view with genae quite strongly constricted behind eyes; posterior ocellus contiguous with eye; FI = 75–80%; occipital carina mediodorsally complete, ventrally curved to join hypostomal carina about 0.7 times the basal mandibular width away from mandible. Antenna moderately long, stout, with 57–59 flagellar segments; 20th segment 1.9–2.0 times as long as broad.

Mesoscutum weakly polished with very fine scattered punctures, in profile evenly rounded; notauli vestigial. Mesopleuron polished, the upper part finely punctate, the lower part similar but more closely punctate, sometimes tending to punctostriate anteriorly; lateral part of epicnemial carina straight, its upper end evanescent, abruptly curved towards anterior margin of pleuron. Scutellum in profile evenly rounded, laterally carinate for all of its length; scutellum in dorsal view 1.6–1.7 times as long as anteriorly broad, very sparsely punctate, posteriorly wrinkled. Metapleuron convex, with coarse striae radiating from propodeum, grading anteroventrally to punctate; submetapleural carina strongly broadened anteriorly; posterior transverse carina of mesosternum usually broadly incomplete centrally, rarely narrowly incomplete but then with carina very weak. Propodeum in profile rather short, abruptly declivous; anterior transverse carina strong, most usually strongly raised centrally and less so laterally; posterior transverse carina represented by blunt lateral tubercles; anterior area short, strongly impressed, from almost smooth to coarsely striate; spiracular area short, smooth; posterior area rather flattened dorsally, centrally with one or sometimes more longitudinal ridges, laterally coarsely transversely striate, the striae often extending on to the metapleuron; lateral longitudinal carina present only as a vestige anteriorly, joined to spiracular margin by a short weak carina.

Fore wing length 15–17 mm; discosubmarginal cell as in Figs 221, 281; AI = 0.69–0.83; CI = 0.29–0.40; ICI = 1.00–1.31; SDI = 1.08–1.23; *cu-a* proximal to base of *Rs&M* by about 0.2 times its own length; marginal cell proximally evenly hirsute; 1st subdiscal cell with anterior 0.6 and distal corner hirsute. Hind wing with 9–10 hamuli on *R*1, the distal three or four a little shorter than the proximal ones; 1st abscissa of *Rs* very weakly curved, 2nd abscissa arcuate.

Fore leg with tibia barely flattened, with about 10 scattered spines on outer surface. Mid leg with longer tibial spur 1.5–1.7 times length of the shorter. Hind leg with coxa in profile 1.7 times as long as deep; trochantellus dorsally 0.1 times as long as broad; 4th segment of tarsus 2.4–2.5 times as long as broad; claws of female long, distally evenly curved, rather evenly pectinate (Fig. 218); claws of male similar.

Gaster quite stout; tergite 2 in profile about 2.5 times as long as posteriorly deep, laterotergite folded under, thyridia large, oval and separated from anterior margin of tergite by about 3 times its own length; tergite 7 unusual, in that in profile it is strongly concave posteriorly (Fig. 92). Ovipositor proximally stout, distally slender and slightly decurved, its sheath quite broad. Male with sternites 7–9 bearing dense thick erect pubescence; gonosquama posteriorly truncate.

Colour generally yellowish orange; mesoscutum with three dark longitudinal vittae; interocellar area usually black; antennae, especially basally, infuscate; gaster orange-brown, usually with tergites 3+ blackish brown and unusual in having a pair of lateral spots on tergite 4 and sometimes 3 pale yellow; pterostigma dark brown; wings weakly infumate.

Variation. The colour of the gaster is quite variable in this species. Some specimens have only small pale spots on tergite 4, in others these areas are large and confluent with similar areas on tergite 3. They are not confluent dorsally as there is always a dark dorsal stripe. Many of the Panamanian males have the gaster more or less uniformly pale yellowish orange, but females are darker. Such sexual differences in coloration have not been observed in other populations. One of the Costa Rican specimens examined differs from the remainder in having a slightly granulate metapleuron with barely any striae present, and in having the submetapleural carina barely expanded anteriorly.

There is some variation in the degree of sclerotization of the alar sclerites; they are always more weakly sclerotized in this species than they are in related taxa, but those of some individuals may be extremely weak and possibly ignored. For this reason *E. exoticus* has been taken out in the key in several places. This allows for the central sclerite or all sclerites being overlooked.

Remarks. *Enicospilus exoticus* shares a number of apomorphic features with *E. maritzai* and *E. jesicae*, suggesting the three species are closely inter-related (see discussion on *E. maritzai*). It can easily be distinguished from the other two species as it has very weak alar sclerites (Fig. 281).

Biological Information. *Enicospilus exoticus* is a quite widely distributed species whose range extends from about 10°N in Costa Rica, south to about 15°S in Peru and Brazil (Map 20). Most specimens have been collected between sea-level and 1000 m. The Costa Rican specimens were collected at light in a forest in Braulio Carrillo National Park during February and April. No others are known from this far north. In Panama in forest on Barro Colorado island *E. exoticus* has been collected only rather rarely. The cumulative seasonal data for 1982–5 are:

J	F	M	A	M	J	J	A	S	O	N	D
–	1	–	1	–	3	1	–	1	1	1	–

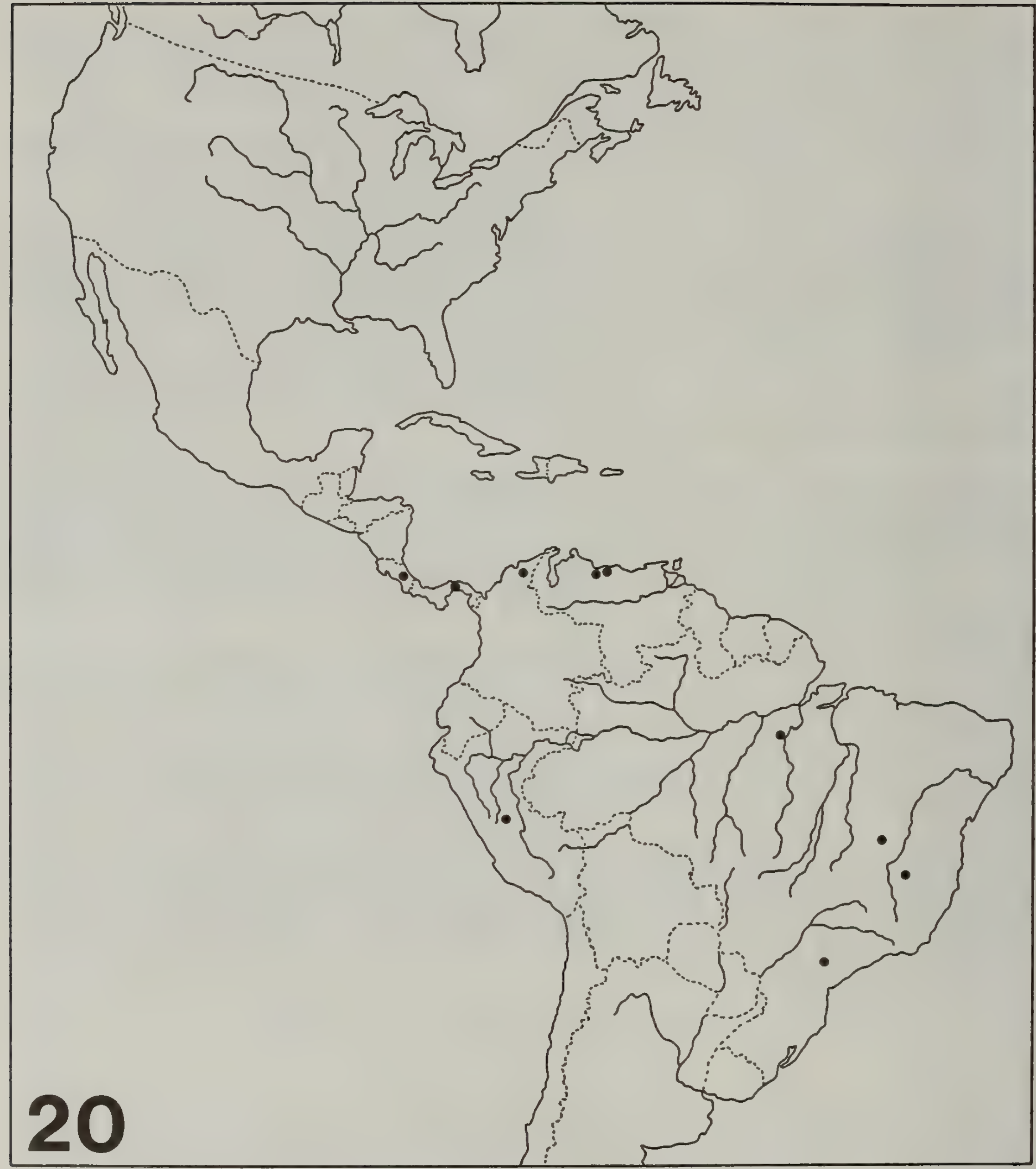
Nothing is known of the hosts of this species.

E. exoticus may be mimicing certain aculeates. When the gaster is viewed dorsally the pale patches on tergites 3 and 4 'disappear' if the insect is on a pale background, and the only parts of the gaster that are visible are the darker anterior and posterior tergites together with the conspicuous dark dorsal stripe on tergites 3–4. Thus, in dorsal aspect the gaster appears to be elongately petiolate, and resembles the gasters of several common and ferocious vespids.

Material Examined

Holotype ♀ (*Henicospilus exoticus* Morley) **Brazil**: Pará (*Bates*) (BMNH). Holotype ♀ (*Ophiomorpha bicolor* Szépligeti) **Brazil**: Minas Gerais (TM).

Brazil: 1 ♀, Aguas Vermelhas, 800 m, xii.1983 (*Alvarenga*) (TC); 4 ♂, 11 ♀, Bahia, Encruzilhada, 960–980 m, xi.1972 & xi.1974 (*Alvarenga*) (TC); 1 ♂, Jacareacanga, vii.1970 (*Barbosa*) (TC); 1 ♀, Minas Gerais, Pedra Azul, 800 m, xi.1972 (*Alvarenga & Seabra*) (TC). **Colombia**: 1 ♀, Magdalena, 800 m, iv.1973 (*Helava*) (BMNH). **Costa Rica**: San José Prov.: 1 ♂, Estacion Carrillo, Braulio Carrillo National Park, 700 m, ii.1985 (*Chacon & Chacon*) (BMNH); 1 ♀, Braulio Carrillo National Park, 500 m, iv.1985 (*Goulet & Masner*) (CNC). **Panama**: 2 ♂, 1 ♀, Barro Colorado Island, iv, vi, xi.1978 (*Wolda*) (RNH); 1 ♀, same



Map 20 Localities at which *Enicospilus exoticus* has been collected.

locality, ix.1982 (*Wolda*) (TC); 1 ♂, 4 ♀, same locality, vi.1983, ii, vi, vii & x.1985 (*Wolda*) (BMNH). **Peru**: 1 ♀, Quincemil, nr Macapata, 30 m, ix.1962 (*Peña*) (TC). **Venezuela**: 1 ♀, Aragua, Rancho Grande, iv.1960 (*Test*) (UM); 1 ♀, Caracas, Colonia Tovar 16.5 km, 1700 m, x.1938 (TC).

Enicospilus jesicae sp. n.

(Fig. 282)

Description. Mandibles of moderate length, strongly but evenly narrowed, apically twisted 70–85°; upper mandibular tooth slightly compressed, 1.4–1.6 times as long as the lower tooth; outer mandibular surface weakly concave. Labrum 0.3 times as long as broad; malar space 0.3 times as long as basal mandibular width. Clypeus in profile weakly convex, margin blunt; clypeus in front view 1.2–1.4 times as broad as long, its apical margin more or less truncate. Lower face 0.5–0.6 times as broad as long, polished, finely punctate. Head in dorsal view with genae evenly narrowed; posterior ocellus contiguous with eye; FI = 85–87%; occipital carina mediodorsally complete, ventrally curved to join hypostomal carina about 0.8 times the basal mandibular width away from mandible. Antenna quite long, moderately stout, with 57–60 flagellar segments; 20th segment 2.1–2.2 times as long as broad.

Mesoscutum weakly polished, with fine scattered punctures, in profile evenly rounded; notauli vestigial. Mesopleuron polished, the upper part finely punctate, the lower part irregularly punctostriate; epicnemial carina inclined towards anterior margin of pleuron. Scutellum in profile weakly convex, laterally carinate for all of its length; scutellum in dorsal view 1.4–1.5 times as long as anteriorly broad, finely punctate, posteriorly wrinkled. Metapleuron moderately to strongly convex, punctostriate, sometimes posterodorsally rugose; submetapleural carina quite strongly broadened anteriorly; posterior transverse carina of mesosternum from quite narrowly to broadly interrupted centrally. Propodeum in profile abruptly declivous; anterior transverse carina strong, often broadened slightly centrally; posterior transverse carina represented by weak to strong lateral tubercles; anterior area short, strongly impressed, striate; spiracular area short, smooth; posterior area generally with median longitudinal carina, laterally coarsely striate, the striae generally extending onto the metapleuron; lateral longitudinal carina present only as a vestige anteriorly, usually joined to spiracular margin by a short carina.

Fore wing length 13–15 mm; discosubmarginal cell as in Fig. 282; AI = 0.63–0.91; CI = 0.10–0.20; ICI = 0.79–0.97; SDI = 1.16–1.19; *cu-a* proximal to base of *Rs&M* by 0.1–0.2 times its own length; marginal cell proximally slightly more sparsely hirsute than it is centrally; 1st subdiscal cell with anterior and distal margins hirsute. Hind wing with 7 hamuli on *R*1, the distal 3 or 4 shorter than the others; 1st abscissa of *Rs* more or less straight, 2nd abscissa weakly arcuate.

Fore leg with tibia barely flattened, with scattered spines on outer surface. Mid leg with longer tibial spur 1.4–1.5 times length of the shorter. Hind leg with coxa in profile 1.7–1.8 times as long as deep; trochantellus dorsally 0.1 times as long as broad; 4th segment of tarsus 2.3–2.5 times as long as broad; claws of female quite long, evenly curved, with stout close pectinae; claws of male similar.

Gaster moderately stout; tergite 2 in profile 3–4 times as long as posteriorly deep, laterotergite folded under, thyridia oval and separated from anterior margin of tergite by 2.5 or more times its own length. Ovipositor proximally stout, distally slender, with fairly conspicuous fine hairs, slightly decurved and with its sheath slightly broadened. Male with sternites 7–9 bearing dense long erect pubescence; gonosquama quite slender, elongately tapered.

Colour generally yellowish brown, mesoscutum generally dark-marked; interocellar area usually black; antennae proximally black; gaster with tergites 1 and 2 reddish brown, 3+ infuscate; pterostigma brown; wings weakly infumate.

VARIATION. There is considerable variation in the colour of the mesoscutum. Most specimens have three dark longitudinal stripes, but occasionally these appear to have coalesced so the mesoscutum is entirely black anteriorly. A few individuals have the mesoscutum brown. The specimens from Santa Rosa National Park include some of the darkest individuals to hand; frequently the black interocellar area extends down the frons onto the central part of the lower face. The two Panamanian specimens are rather pale and have well-developed pale areas on tergites 3 and 4. Some individuals have the interocellar area rather weakly infuscate and allowance has been made for them to run out in two places in the key.

REMARKS. This species is named after Jesica Rodriguez, who will grow up to protect Cerro el Hacha, Guanacaste National Park.

Enicospilus jesicae belongs to the *E. maritzai* species-complex (see discussion of that species). It strongly resembles *E. exoticus* in general structure, especially in the form of the propodeum, but differs in having much more strongly defined sclerites, more slender flagellar segments and (generally) lacking the pale mark on tergite 4.

BIOLOGICAL INFORMATION. The range of *Enicospilus jesicae* extends further north than those of other species in the *E. maritzai* complex. *E. jesicae* is known to occur in southern Mexico, and from there south to Central Brazil and Ecuador. In Costa Rica isolated specimens have been collected in Santa Rosa National Park during the wet season between May and November. Isolated individuals have also been taken in cloud forest at Monteverde and on Volcán Cacao. Nothing is known about the biology of this species.

MATERIAL EXAMINED

Holotype ♀, **Costa Rica**: Guanacaste Prov., Santa Rosa National Park, 300 m, v.1986 (*Gauld*) (BMNH).

Paratypes. **Brazil**: 1 ♀, Bahia, Encruzilhada, 980 m, xi.1974 (*Alvarenga*) (TC). **Costa Rica**: Guanacaste Prov.: 1 ♀, Cerro el Hacha, Casa Oeste, 400 m, x.1987 (*Chacon*) (BMNH); 1 ♂, Estacion Mengo, SW. side of Volcán Cacao, 1100 m, vi.1987 (*Janzen*) (BMNH); 3 ♂, 1 ♀, Santa Rosa National Park, 300 m, vii.1980, xi.1982, x.1983 & v.1985 (*Janzen & Hallwachs*) (BMNH): Puntarenas Prov.: 1 ♀, Monteverde, 1350 m, xi.1985 (*Haber*) (BMNH); 1 ♀, same locality, ii.1986 (*Forsyth*) (CNC). **Ecuador**: 1 ♀, Playas de Montalvro, 15 m, iii.1938 (*Clarke & McIntyre*) (TC); 2 ♀, Quevedo, v.1976 (*Fritz*) (TC). **Mexico**: Chiapas: 1 ♂, 32 km N. Huixtla, 1000 m, vi.1969 (CNC). **Panama**: 2 ♀, Barro Colorado Island, iv.1941 (*Zetek*) (USNM); 2 ♀, same locality, 120 m, v.1984, vi.1985 (*Wolda*) (BMNH).

Enicospilus corcovadoi sp. n.

(Figs 120, 130, 283)

Description. Mandibles rather short, strongly and evenly narrowed, apically twisted 30–50°; upper mandibular tooth slender, 1.3–1.4 times as long as the lower tooth which is very stout, swollen and has a sharp cutting edge ventrally (Fig. 120); outer mandibular surface more or less flat, with long fine scattered hairs. Labrum 0.1 times as long as broad; malar space 0.2–0.3 times as long as basal mandibular width. Clypeus in profile moderately convex, margin blunt; clypeus in front view 1.3–1.4 times as broad as long, the apical weakly convex. Lower face 0.6–0.7 times as broad as long, finely punctate. Head in dorsal view rather more quadrate than that of most species, with genae rather long, weakly constricted behind eyes (Fig. 130); posterior ocellus contiguous with eye; FI = 68–70%; occipital carina mediodorsally complete, ventrally curved to join hypostomal carina about 0.6 times the basal mandibular width away from mandible. Antenna slender, with 61 flagellar segments; 20th segment 2.3–2.4 times as long as broad.

Mesoscutum polished, finely punctate, in profile evenly rounded; notauli vestigial. Mesopleuron polished, the upper part finely but quite closely punctate, the lower part similar but with indications of striae present anteriorly; epicnemial carina inclined towards but not reaching anterior margin of pleuron, its lower corner rather sharp and slightly raised. Scutellum in profile weakly convex, laterally carinate for 0.6 of its length; scutellum in dorsal view 1.6 times as long as anteriorly broad, finely alutaceous. Metapleuron rather weakly convex, posterodorsally diagonally striate, anteroventrally punctate; submetapleural carina evenly anteriorly broadened; posterior transverse carina of mesosternum complete. Propodeum in profile evenly rounded; anterior transverse carina complete or narrowly incomplete at lateral extremities, posterior transverse carina absent; anterior area moderately long, quite steep, striate; spiracular area moderately long, smooth; posterior area rugose, with the rugae tending to be concentric dorsally; lateral longitudinal carina complete at least on anterior 0.5, sometimes joined to spiracular margin by a short, very weak carina.

Fore wing length 14 mm; discosubmarginal cell as in Fig. 283; AI = 1.04–1.13; CI = 0.31–0.32; ICI = 0.49–0.50; SDI = 1.10–1.13; *cu-a* proximal to the base of *Rs&M* by about 0.2 times its own length; marginal cell proximally slightly more sparsely pubescent; 1st subdiscal cell with anterodistal part sparsely hirsute. Hind wing with 5 hamuli on *R*1; 1st abscissa of *Rs* straight, 2nd abscissa almost straight.

Fore leg with tibia slightly flattened, with scattered spines on outer surface. Mid leg with longer tibial spur 1.4–1.7 times length of the shorter. Hind leg with coxa in profile 1.7 times as long as deep; trochantellus dorsally 0.1 times as long as broad; 4th segment of tarsus 2.4–2.6 times as long as broad; claws of female moderately long, evenly curved, with long close pectinae; claws of male similar, but with pectinae slightly shorter.

Gaster slender; tergite 2 in profile 5–6 times as long as posteriorly deep, laterotergite folded under, thyridia oval and separated from anterior margin of tergite by 4–9 times its own length. Ovipositor slender, its sheath narrow. Male with sternites 7–9 bearing dense, long stout erect pubescence.

Colour generally orange-yellow, with mesoscutum reddish brown; interocellar area blackish, often with a dark mark extending ventrally on frons between bases of antennae; antenna blackish, but with scape, pedicel and part of first flagellar segment brownish; terminal segments of gaster weakly to moderately infuscate; hind tibia and tarsus slightly infuscate. Pterostigma blackish; wings weakly infumate.

Variation. The terminal segments of the gaster of the male are less infuscate than are those of the female.

Remarks. The rather small, somewhat quadrate head is particularly characteristic of this species, though *E. fernaldi* has a rather similar head form. The two species may be related, but *E. corcovadoi* can easily be distinguished by the form of the mandibles. Those of *E. fernaldi* are less strongly twisted and have a much more slender lower tooth than those of *E. corcovadoi*.

Biological Information. *Enicospilus corcovadoi* is only known to occur in wet lowland forests in the southern part of Central America. It has only rarely been collected and nothing is known of its hosts.

MATERIAL EXAMINED

Holotype ♂, **Costa Rica**: Osa Peninsula, Corcovado National Park, 20 m, v.1984 (*Gauld*) (BMNH). Paratype. **Panama**: 1 ♀, Darién, 1967 (*Triplehorn*) (TC).

Enicospilus lovejoyi sp. n.

(Figs 181, 284)

DESCRIPTION. Mandibles short, quite strongly narrowed, apically twisted 75–80°; upper mandibular tooth slightly compressed, 1.2–1.4 times as long as the lower tooth; outer mandibular surface finely pubescent, with a weak basal concavity. Labrum 0.2 times as long as broad; malar space 0.2 times as long as basal mandibular width. Clypeus in profile weakly convex, margin blunt; clypeus in front view 1.2–1.3 times as broad as long, its apical margin more or less truncate. Lower face 0.6–0.7 times as broad as long, polished, virtually smooth. Head in dorsal view with genae strongly constricted; posterior ocellus very close to eye; FI = 60–65%; occipital carina mediodorsally complete, ventrally curved to join hypostomal carina about 0.6 times the basal mandibular width away from mandible. Antenna long and slender, with 47–50 flagellar segments; 20th segment 1.9–2.1 times as long as broad.

Mesoscutum polished, with indistinct punctures, in profile abruptly rounded; notauli very weak. Mesopleuron polished, the upper part very sparsely punctate, the lower part punctate to punctostriate; epicnemial carina slightly curved towards anterior margin of pleuron, but with upper end evanescent. Scutellum in profile evenly rounded, laterally carinate for all of its length; scutellum in dorsal view 1.3–1.4 times as long as anteriorly broad, smooth with isolated punctures, occasionally with a few striae posteriorly. Metapleuron weakly to moderately convex, finely punctate (Fig. 181); submetapleural carina weakly broadened anteriorly; posterior transverse carina of mesosternum usually complete, sometimes narrowly interrupted centrally. Propodeum in profile evenly rounded; anterior transverse carina present, weak laterally, posterior transverse carina absent; anterior area moderately long, sparsely striate; spiracular area long, smooth; posterior area with weak irregular transverse striations; lateral longitudinal carina usually complete, sometimes joined to spiracular margin by a short weak carina, or sometimes absent.

Fore wing length 9–12 mm; discosubmarginal cell as in Fig. 284 (but note many of the hairs have been rubbed off the central part of the discosubmarginal cell in this specimen); AI = 0.55–1.00; CI = 0.25–0.42; ICI = 0.29–0.41; SDI = 1.14–1.18; *cu-a* opposite or slightly proximal to the base of *Rs&M*; marginal cell proximally sparsely pubescent, generally with a distinct glabrous area adjacent to *Rs+2r*; 1st subdiscal cell with anterior and distal parts sparsely hirsute. Hind wing with 4–6 hamuli on *R*1; 1st abscissa of *Rs* straight, 2nd abscissa almost straight.

Fore leg with tibia slightly flattened, with fine scattered spines on outer surface. Mid leg with longer tibial spur 1.4–1.5 times length of the shorter. Hind leg with coxa in profile 1.8–1.9 times as long as deep; trochantellus dorsally 0.1–0.3 times as long as broad; 4th segment of tarsus 3.0–3.1 times as long as broad; claws of female long, quite strongly curved apically, with short pectinae.

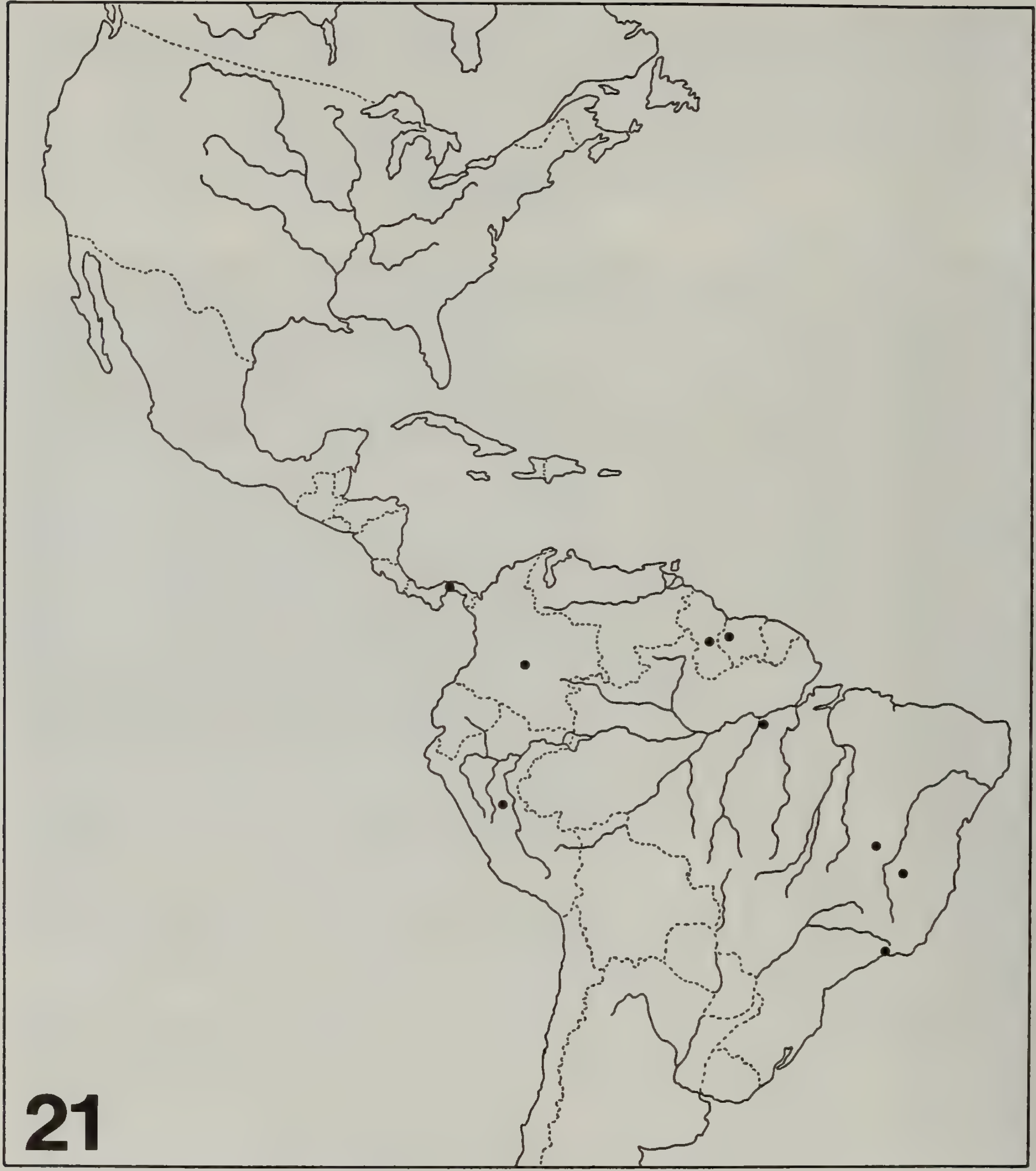
Gaster slender; tergite 2 in profile 5 or more times as long as posteriorly deep, laterotergite turned under, thyridia elliptical and separated from anterior margin of tergite by about 3.5–4.0 times its own length. Ovipositor moderately slender, its sheath slightly broadened. Male unknown. Colour generally yellowish brown with profuse pale irregular markings on alitrunk; mesoscutal vittae blackish and upper posterior corner of mesopleuron bearing an irregular black mark; head yellow, interocellar area black; antenna brown, basally slightly infuscate; pterostigma brown; wings hyaline.

VARIATION. *Enicospilus lovejoyi* is a morphologically rather uniform species, but southern Brazilian specimens have paler alitrunks than those from the northern end of its range.

REMARKS. This species is named in honour of Thomas Lovejoy in recognition of his many contributions to Neotropical conservation biology.

Enicospilus lovejoyi is a small, distinctive species which may easily be recognized by the combination of the form of the alar sclerites and the black interocellar area. The strong continuous distal sclerite, the mesopleural dark mark and the short, strongly twisted mandibles are apomorphic features that are also found in *E. liesneri*, *E. marini* and *E. pescadori*, and it is probable all are closely related. *E. lovejoyi* and *E. liesneri* have very similar modified heads (see remarks under *E. liesneri*) suggesting they are sister species.

BIOLOGICAL INFORMATION. *Enicospilus lovejoyi* is a widely distributed species whose range extends from Central Panama south to Peru and Central Brazil (Map 21). The Panamanian specimen was collected in lowland rainforest, but the general habitat preference and host range of this species are not known.



Map 21 Localities at which *Enicospilus lovejoyi* has been collected.

MATERIAL EXAMINED

Holotype ♀, **Brazil**: Pará, Santarem, x-xi.1966 (*Knowles*) (BMNH).

Paratypes. **Brazil**: 2 ♀, Aguas Vermelhas, 800 m, xii.1983 (*Alvarenga*) (TC); 1 ♀, Bahia, Encruzilhada, 980 m, xi.1974 (*Alvarenga*) (TC); 1 ♀, Guanabara, Represa Río Grande, xii.1969 (*Alvarenga*) (TC). **Colombia**: 1 ♀, Camp Sautata, Río Atrato, xi-xii.1967 (TC). **Guyana**: 2 ♀, R. Essequibo, Rockstone, iii.1913 (*Bodkin*) (BMNH). **Panama**: 1 ♀, Barro Colorado Island, Gatun Lake, iv.1979 (*Wolda*) (TC). **Peru**: 1 ♀, Loreto, Pucallpa, viii.1963 (*Schunke*) (BMNH). **Surinam:** 1 ♀, Marowijne R., vii.1965 (*Gale*) (BMNH).

Enicospilus hacha sp. n.

(Figs 113, 119, 131, 182, 285)

DESCRIPTION. Mandibles moderately long, with a pronounced proximoventral lobe, distally evenly narrowed and apically twisted 75–85° (Fig. 119); upper mandibular tooth slightly depressed, 1.4–1.6 times as long as the lower tooth; outer mandibular surface rather finely and sparsely pubescent, with a shallow proximal concavity. Labrum 0.2 times as long as broad; malar space 0.3 times as long as basal mandibular width. Clypeus in profile weakly convex, margin slightly impressed, quite sharp; clypeus in front view 1.3–1.4 times as broad as long, its apical margin more or less truncate. Lower face 0.6–0.7 times as broad as long, with fine sparse punctures. Head in dorsal view with genae strongly constricted behind eyes (Fig. 131); posterior ocellus more or less contiguous with eye; FI = 65–70%; occipital carina mediodorsally complete, ventrally curved to join hypostomal carina about 0.8–1.0 times the basal mandibular width away from mandible. Antenna long and slender, with 55–60 flagellar segments; 20th segment 2.3–2.5 times as long as broad.

Mesoscutum weakly polished, without obvious punctures, in profile abruptly rounded; notauli absent. Mesopleuron polished, the upper part finely and sparsely punctate, the lower part usually more closely punctate, often with incipient traces of striations observable; epicnemial carina inclined towards anterior margin of pleuron, but its upper end not reaching this margin. Scutellum in profile weakly convex, laterally carinate for all of its length; scutellum in dorsal view 1.5–1.6 times as long as anteriorly broad, from smooth with isolated punctures to weakly coriaceous. Metapleuron moderately strongly convex, from transversely striate to irregularly vermiculate (Fig. 182); submetapleural carina evenly anteriorly broadened; posterior transverse carina of mesosternum complete. Propodeum in profile evenly declivous; anterior transverse carina complete, posterior transverse carina absent or indicated by weak wrinkling; anterior area short and quite deeply impressed, striate; spiracular area moderately long, smooth; posterior area rather coarsely reticulate; lateral longitudinal carina with at least anterior 0.7 complete, joined to spiracular margin by a short carina.

Fore wing length 12–14 mm; discosubmarginal cell as in Fig. 285; AI = 1.00–1.32; CI = 0.25–0.42; ICI = 0.44–0.54; SDI = 1.09–1.31; *cu-a* distal to the base of *Rs&M* by about 0.3 times its own length; marginal cell proximally rather sparsely hirsute; 1st subdiscal cell with anterior and distal parts sparsely hirsute. Hind wing with 6 hamuli on *R*1; 1st and 2nd abscissa of *Rs* more or less straight.

Fore leg with tibia somewhat flattened, with scattered spines on outer surface. Mid leg with longer tibial spur 1.3–1.5 times length of the shorter. Hind leg with coxa in profile 1.7–1.8 times as long as deep; trochantellus dorsally 0.1 times as long as broad; 4th segment of tarsus 2.4–2.5 times as long as broad; claws of female of moderate length, abruptly curved apically, with close long pectinae; claws of male similar but with pectinae shorter.

Gaster slender; tergite 2 in profile more than 6 times as long as posteriorly deep, laterotergite folded under, thyridia elliptical and separated from anterior margin of tergite by about 3 or more times its own length. Ovipositor slender, its sheath narrow. Male with sternites 7–9 bearing moderately dense long erect pubescence; gonosquama quite slender, dorsally more strongly tapered than it is ventrally.

Colour generally yellowish orange; interocellar area, antenna and tergites 3+ of gaster black; mesoscutum infuscate. Pterostigma brownish; wings more or less hyaline.

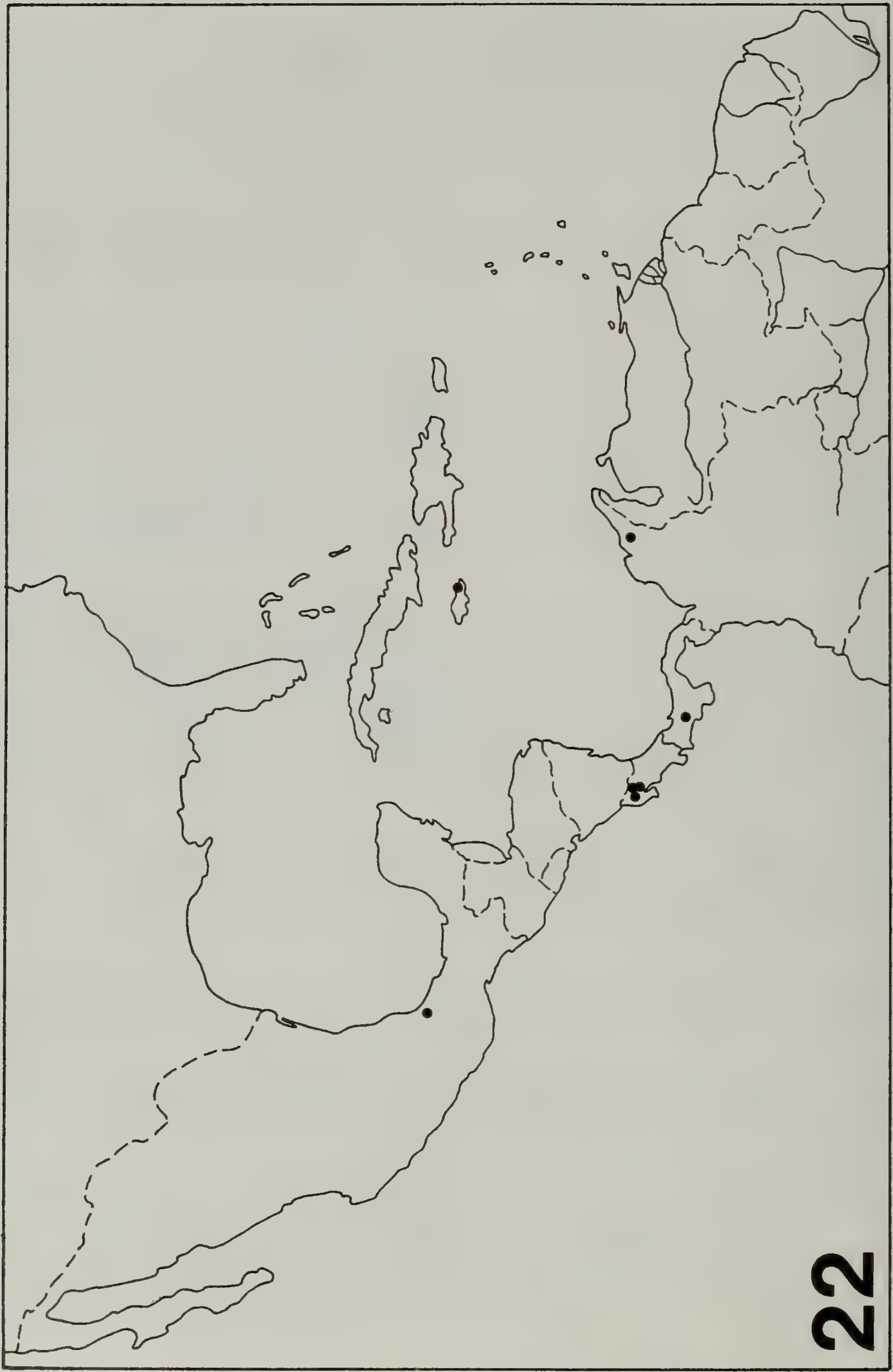
VARIATION. *Enicospilus hacha* is a morphologically rather uniform species that shows a small amount of variation in the sculpture of the meso- and metapleurae, as detailed above. The Jamaican specimen is almost uniformly pale yellowish, and lacks the dark marks present on individuals from other localities.

REMARKS. *Enicospilus hacha* may be recognized most easily by the characteristic form of the central sclerite (Fig. 285) and the possession of a strongly sclerotized complete, distal sclerite. In this latter feature, and in the form of the mandibles, *E. hacha* resembles *E. lovejoyi* and it is possible that the two species are related.

BIOLOGICAL INFORMATION. *Enicospilus hacha* is a Central American and tropical South American species whose range extends from central Mexico south to Colombia (Map 22). It is also known to occur on the island of Jamaica. In Costa Rica this species has only been collected in the north-western part of the country, in Guanacaste or just across the watershed in northern Alajuela. It is present at more humid sites in December, February and March, but it has only been collected in dry forest sites during the wetter months of year. For example, in Santa Rosa National Park it has been collected in May and August, and on Cerro el Hacha it was taken between August and January. Nothing is known of the host range of this species.

MATERIAL EXAMINED

Holotype ♀, **Costa Rica**: Guanacaste Prov., Guanacaste National Park, Cerro el Hacha, 3–400 m, viii-xi.1986 (*Janzen & Hallwachs*) (BMNH).



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Map 22 Localities at which *Enicospilus hacha* has been collected.

Paratypes. **Colombia**: 1 ♀, Magdalena, 800 m, iv.1973 (*Heleva*) (BMNH). **Costa Rica**: Alajuela Prov.: 1 ♀, Finca San Gabriel, 750 m, iii.1984 (*Janzen*) (BMNH): Guanacaste Prov.: 1 ♀, Cerro el Hacha, 3–400 m, i.1987 (*Janzen & Hallwachs*) (BMNH); 1 ♂, 1 ♀, Rincón de la Vieja National Park, 4 km E. Casetilla, 750 m, xii.1981, ii.1983 (*Janzen & Hallwachs*) (BMNH); 1 ♀, 5 km NE. of Quebrada Grande, 600 m, vi.1986 (*Gauld*) (BMNH); 1 ♂, 1 ♀, Santa Rosa National Park, 300 m, v & viii.1983 (*Janzen & Hallwachs*) (BMNH). **Jamaica**: 1 ♀, Port Antonio, Bonnie View, vii.1952 (FSCA). **Mexico**: Veracruz: 1 ♂, L. Catemaco, 11 km N. Hotel Playa Azul, *ca* 400 m, viii.1963 (*Weems*) (FSCA). **Panama**: 1 ♀, Cerro Campana, vii.1970 (*Howden & Howden*) (TC)

Enicospilus xanthostigma (Szépligeti)

(Figs 114, 118, 122, 183, 286)

Henicospilus xanthostigma Szépligeti, 1906: 147. Holotype ♂, BRAZIL (TM) [examined.]
Enicospilus xanthostigma (Szépligeti) Hooker, 1912: 91.

DESCRIPTION. Mandibles moderately long, with a proximoventral lobe, distally evenly narrowed and apically twisted 70–75°; upper mandibular tooth slightly compressed, 1.2–1.4 times as long as the lower tooth (Fig. 118); outer mandibular surface sparsely pubescent, more or less flat. Labrum 0.2–0.3 times as long as broad; malar space 0.3–0.4 times as long as basal mandibular width. Clypeus in profile weakly convex, margin acute; clypeus in front view 1.3–1.5 times as broad as long, the margin apically weakly convex. Lower face 0.6–0.7 times as broad as long, polished, virtually impunctate. Head in dorsal view with genae rounded behind eye; posterior ocellus very close to but not touching eye; FI = 60–65%; occipital carina mediodorsally complete, ventrally joining hypostomal carina about 0.7 of basal width away from the mandible (Fig. 114). Antenna very long and slender, with 56–65 flagellar segments; 20th segment 3.0–3.2 times as long as broad.

Mesoscutum polished, with minute inconspicuous punctures, in profile abruptly rounded anterior margin out-turned; notauli absent. Mesopleuron polished, the upper part smooth and shining, the lower part similar but with fine punctures; epicnemial carina evenly curved towards anterior margin of pleuron. Scutellum in profile weakly convex, laterally carinate for all of its length; scutellum in dorsal view 1.5 times as long as anteriorly broad, finely and indistinctly punctate, striate posteriorly. Metapleuron very weakly convex, polished with obsolescent punctures (Fig. 183); submetapleural carina evenly anteriorly broadened; posterior transverse carina of mesosternum complete. Propodeum in profile evenly declivous; anterior transverse carina complete, posterior transverse carina absent; anterior area moderately long, rather shallowly impressed, striate; spiracular area long, smooth; posterior area with very weak coriaceous sculpture; lateral longitudinal carina complete, usually joined to spiracular margin by a short carina.

Fore wing length 10–11 mm; discosubmarginal cell as in Fig. 286; AI = 0.59–1.06; CI = 0.26–0.37; ICI = 0.23–0.40; SDI = 0.86–1.07; *cu-a* from distal to the base of *Rs&M* by about 0.2 times its own length to slightly proximal to this vein; marginal cell proximally glabrous; 1st subdiscal cell distally sparsely pubescent. Hind wing with 4–5 hamuli on *R*1; 1st abscissa of *Rs* straight, 2nd abscissa weakly arcuate.

Fore leg with tibia very weakly flattened, with scattered spines on outer surface. Mid leg with longer tibial spur 1.8–1.9 times length of the shorter. Hind leg with coxa in profile 1.8–1.9 times as long as deep; trochantellus dorsally 0.2 times as long as broad (Fig. 122); 4th segment of tarsus 2.6–2.7 times as long as broad; claws of female moderately long, fairly abruptly curved apically, with stout close pectinae.

Gaster slender; tergite 2 in profile at least 6 times as long as posteriorly deep, laterotergite turned under, thyridia oval and separated from anterior margin of tergite by about 3.0–3.5 times its own length. Ovipositor apically slender, its sheath narrow. Male with sternites 6–9 bearing very long, erect pubescence; gonosquama apically acute.

Colour generally golden yellowish with irregular pale markings on the head and on the alitrunk laterally; mesoscutum brown or infuscate; mesopleuron with a very weak to quite distinct dark mark in posterodorsal corner; gaster with tergites 5+ infuscate; interocellar area and vertex extensively black; antenna infuscate; pterostigma brown; wings hyaline.

VARIATION. The Mexican specimens have the entire anterior part of the mesoscutum blackish whereas in South American specimens this is brown.

REMARKS. *Enicospilus xanthostigma* is a small species that is most easily recognized by the characteristic form of the alar sclerites. It is structurally very similar to *Enicospilus cepillo*, which it closely resembles in venation and form of the proximal sclerite. The two are most easily distinguished by the mandibles; those of *E. xanthostigma* are more strongly twisted. *E. xanthostigma* also has a shorter hind trochantellus than *E. cepillo*. It also resembles an undescribed Brazilian species (in TC), which differs most obviously in having infumate markings in the wing.

Biological Information. *Enicospilus xanthostigma* is a widely distributed, but seldom collected species whose range extends from southern Mexico, south into Ecuador, Peru and Brazil. Although it has not been collected in Central America its known distribution suggests it may occur there. Most specimens have been collected at altitudes between 400 and 1000 m.

Material Examined

Holotype ♂, **Brazil**: Blumenau (TM).

Ecuador: 2 ♀, Napo & Coca Rivers, v.1965 (*Peña*) (TC); 1 ♀, Pichincha, Tinalandia, 16 km SE. Santo Domingo, vi.1976 (*Peck & Peck*) (TC). **Mexico**: Chiapas: 1 ♀, 32 km N. Huixtla, vi.1969 (CNC); 3 ♀, Muste, nr Huixtla, 440 m, ix.1970 (*Welling*) (CNC). **Peru**: 2 ♀, Quincemil, nr Marcapata, 750 m, xi.1962 (*Peña*) (TC).

Enicospilus cepillo sp. n.

(Figs 115, 117, 121, 287)

Description. Mandibles short, quite strongly and evenly tapered, apically twisted 10–20°; upper mandibular tooth slightly depressed, 1.3–1.5 times as long as the lower tooth (Fig. 117); outer mandibular surface with a weak longitudinal concavity. Labrum 0.2 times as long as broad; malar space 0.1–0.2 times as long as basal mandibular width. Clypeus in profile weakly convex, margin blunt; clypeus in front view 1.5–1.6 times as broad as long, the margin apically truncate. Lower face 0.70–0.76 times as broad as long, smooth and polished, centrally punctate. Head in dorsal view with genae constricted behind eyes; posterior ocellus contiguous with eye; FI = 65–70%; occipital carina mediodorsally complete, ventrally evanescent, not joining hypostomal carina (Fig. 115). Antenna very long and slender, with 52–56 flagellar segments; 20th segment 2.5–2.8 times as long as broad.

Mesoscutum polished, smooth, in profile steeply rounded; notauli absent. Mesopleuron highly polished, the upper and lower parts finely and sparsely punctate; epicnemial carina inclined towards anterior margin of pleuron. Scutellum in profile weakly convex, laterally carinate for 0.8–0.9 of its length; scutellum in dorsal view 1.3–1.5 times as long as anteriorly broad, smooth. Metapleuron very weakly convex, polished, finely and sparsely punctate; submetapleural carina evenly broadened anteriorly; posterior transverse carina of mesosternum broadly incomplete centrally. Propodeum in profile evenly rounded; anterior transverse carina complete, posterior transverse carina absent; anterior area quite short, weakly impressed, from smooth to slightly coriaceous; spiracular area exceptionally long, smooth; posterior area virtually smooth, at most with very weak rugosities; lateral longitudinal carina weak, but usually discernible anteriorly, sometimes complete, not joined to spiracular margin by a short carina.

Fore wing length 8–9 mm; discosubmarginal cell as in Fig. 287; AI = 0.98–1.29; CI = 0.17–0.24; ICI = 0.39–0.47; SDI = 1.05–1.15; *cu-a* virtually opposite to the base of *Rs&M*; marginal cell with proximal corner broadly glabrous ; 1st subdiscal cell with scattered hairs anteriorly and distally. Hind wing with 5 hamuli on *R*1; 1st abscissa of *Rs* straight, 2nd abscissa straight.

Fore leg with tibia moderately flattened, with scattered weak spines on outer surface. Mid leg with longer tibial spur 1.4–1.6 times length of the shorter. Hind leg with coxa in profile 1.8–1.9 times as long as deep; trochantellus dorsally 0.5–0.6 times as long as broad (Fig. 121); 4th segment of tarsus 2.3–2.4 times as long as broad; claws of female short, abruptly curved with short close pectinae, those of male similar.

Gaster slender; tergite 2 in profile more than 5 times as long as posteriorly deep, laterotergite generally folded under, thyridia oval to elliptical and separated from anterior margin of tergite by about 2–3 times its own length. Ovipositor slender, its sheath narrow. Male with sternites 7–9 bearing long fine sparse pubescence and with a few long stout erect bristles along posterior margin; gonosquama evenly rounded.

Colour generally with head, scutellum and lateral parts of alitrunk yellow, gaster yellowish brown; maxillary and labial palps infuscate; mesoscutal vittae and upper posterior margin of mesopleuron dark brown; interocellar area black; antenna dark brown; pterostigma yellowish brown; wings hyaline.

Variation. This is structurally a rather uniform species, but the flagellum of one of the Panamanian specimens is slightly paler than those of the other specimens.

Remarks. *Enicospilus cepillo* is a very distinctive species on account of the ventrally incomplete occipital carina, broadly incomplete posterior transverse carina of the mesosternum and long hind trochantellus. The male is unusual in having exceptionally stout bristles only along the hind margin of the sternites. Structurally it otherwise resembles *E. xanthostigma*, and the two species may be closely related.

Biological Information. *Enicospilus cepillo* is a rarely collected species whose range extend from the Isthmus of Panama south to Peru and Central Brazil. In Panama it has been collected in lowland rainforest, but its hosts are not known.

MATERIAL EXAMINED

Holotype ♀, **Panama**: Barro Colorado Island, 120 m, vii.1985 (*Wolda*) (BMNH).

Paratypes. **Brazil**: 1 ♀, Bahia, Encruzilhada, 980 m, xi.1974 (*Alvarenga*) (TC). **Panama**: 1 ♀, Barro Colorado Island, 120 m, v.1985 (*Wolda*) (BMNH); 1 ♀, Tucaman, i.1953 (USNM). **Peru**: 1 ♂, Loreto, Pucallpa, i.1952 (*Schunke*) (BMNH).

Enicospilus persimilis (Szépligeti)

(Fig. 288)

Henicospilus persimilis Szépligeti, 1906: 147. Holotype ♂, PERU (TM) [examined].
[*Enicospilus fuscipennis* (Szépligeti) Hooker, 1912: 89. In part, misidentification.]
Enicospilus persimilis (Szépligeti) Townes & Townes, 1966: 183.

DESCRIPTION. Mandibles moderately long, quite strongly and evenly tapered, apically twisted 20–30°; upper mandibular tooth slightly depressed 1.2–1.4 times as long as the lower tooth which is distinctly the stouter of the two; outer mandibular surface with a few long scattered hairs proximally, distally flat but with a weak proximal concavity. Labrum 0.2 times as long as broad; malar space 0.2 times as long as basal mandibular width. Clypeus in profile almost flat, margin subacute; clypeus in front view 1.3–1.4 times as broad as long, the margin weakly convex. Lower face 0.68–0.70 times as broad as long, polished, centrally striate. Head in dorsal view with genae constricted behind eyes; posterior ocellus contiguous with eye; FI = 65–70%; occipital carina mediodorsally complete, ventrally curved to join hypostomal carina about 1.0 times the basal mandibular width away from mandible. Antenna long and slender, with 58–61 flagellar segments; 20th segment 2.3–2.7 times as long as broad.

Mesoscutum polished, finely punctate, in profile steeply rounded; notauli absent. Mesopleuron polished, the upper part punctate, the lower part punctostriate to striate; epicnemial carina inclined towards anterior margin of pleuron, its upper end evanescent. Scutellum in profile weakly convex, laterally carinate for 0.8 or more of its length; scutellum in dorsal view 1.6 times as long as anteriorly broad, anteriorly smooth, posteriorly striate. Metapleuron weakly to moderately convex, diagonally striate, weakly polished; submetapleural carina quite strongly anteriorly broadened; posterior transverse carina of mesosternum complete. Propodeum in profile evenly rounded; anterior transverse carina complete except at extreme lateral extremities, posterior transverse carina absent; anterior area quite steep, shagreened with a few irregular striae; spiracular area moderately long, smooth; posterior area from coarsely concentrically striate to irregularly transversely wrinkled; lateral longitudinal carina complete, sometimes joined to spiracular margin by a short weak carina.

Fore wing length 14–15 mm; discosubmarginal cell as in Fig. 288; AI = 1.19–1.72; CI = 0.44–0.50; ICI = 0.42–0.45; SDI = 1.13–1.27; *cu-a* proximal to the base of *Rs&M* by 0.3–0.4 times its own length; marginal cell with proximal corner entirely glabrous; 1st subdiscal cell with anterior 0.4 hirsute, proximal end entirely glabrous. Hind wing with 5–6 hamuli on *R*1; 1st abscissa of *Rs* straight, 2nd abscissa almost straight.

Fore leg with tibia very weakly flattened, with slender, inconspicuous spines on outer surface. Mid leg with longer tibial spur 1.7–1.8 times length of the shorter. Hind leg with coxa in profile 1.8–1.9 times as long as deep; trochantellus dorsally 0.1 or less times as long as broad; 4th segment of tarsus 2.5–2.6 times as long as broad; claws of female long, abruptly curved, with stout incurved pectinae; claws of male similar but with pectinae finer.

Gaster long and slender; tergite 2 in profile 6 times as long as posteriorly deep, laterotergite folded under, thyridia elliptical and separated from anterior margin of tergite by about 3 times its own length. Ovipositor slender, its sheath narrow. Male with sternites 7–9 bearing short fine decumbent pubescence; gonosquama apically evenly rounded.

Colour generally orange brown with head paler yellowish and tergites 3+ of gaster infuscate; interocellar area black; antenna blackish; pterostigma blackish brown; wings weakly infumate.

VARIATION. The Panamanian and Surinamese specimens are extremely similar, so similar in fact that they would pass as having come from the same locality.

REMARKS. The characteristic inverted J-shaped central sclerite (Fig. 288) makes *Enicospilus persimilis* one of the most easily recognized of all Neotropical species. In general structure, venation and form of the proximal sclerite it resembles *E. madrigalae* and *E. duckworthi*, and these species may well be closely related. The central sclerite of *E. duckworthi* is oval and that of *E. madrigalae* is linear.

BIOLOGICAL INFORMATION. *Enicospilus persimilis* is an uncommon species in collections and is only known from three specimens, the holotype male from Peru, and two females, one collected in Surinam, and a second collected in lowland rainforest on Barro Colorado Island, Panama. Nothing is known about the biology.

MATERIAL EXAMINED

Holotype ♂, **Peru**: Pachitea (TM).

Panama: 1 ♀, Barro Colorado Island, v.1941 (*Zetek*) (USNM). **Surinam**: 1 ♀, Lavva Anapaike, xi.1963 (*Ligorie*) (TC).

Enicospilus fernaldi Hooker

(Figs 184, 289)

Enicospilus fernaldi Hooker, 1912: 63. Lectotype ♀, DOMINICAN REPUBLIC (USNM), designated by Townes & Townes (1966: 177) [examined].
Enicospilus fernaldi Hooker; Brues & Richardson, 1913: 496.

DESCRIPTION. Mandibles fairly short, evenly narrowed, apically twisted 15–20°; upper tooth strongly depressed, slender, 1.2–1.5 times as long as the lower tooth; outer mandibular surface finely pubescent, distally weakly concave, but without a distinct proximal concavity. Labrum 0.2 times as long as broad; malar space 0.3–0.4 times as long as basal mandibular width. Clypeus in profile weakly to moderately convex, margin blunt; clypeus in front view 1.2–1.4 times as broad as long, the apical margin weakly convex. Lower face 0.65–0.75 times as broad as long, finely punctate, often with punctures centrally grading to striae. Head in dorsal view with genae evenly constricted behind eyes; posterior ocellus very close to eye; FI = 60–65%; occipital carina mediodorsally complete, ventrally curved to join hypostomal carina about 0.9–1.0 times the basal mandibular width away from mandible. Antenna slender, with 55–57 flagellar segments; 20th segment 2.1–2.2 times as long as broad.

Mesoscutum polished, finely and inconspicuously punctate, in profile evenly rounded; notauli vestigial. Mesopleuron weakly polished, the upper part centrally smooth, peripherally finely punctate to punctostriate, the lower part punctostriate to striate; epicnemial carina inclined towards but not reaching anterior margin of pleuron. Scutellum in profile weakly convex, laterally carinate for 0.6 or more of its length; scutellum in dorsal view 1.5–1.6 times as long as anteriorly broad, smooth or finely punctate, grading posteriorly into irregularly wrinkled. Metapleuron moderately convex, quite coarsely punctostriate to coriaceous (Fig. 184); submetapleural carina evenly anteriorly broadened; posterior transverse carina of mesosternum complete. Propodeum in profile fairly abruptly declivous; anterior transverse carina complete except at lateral extremities, posterior transverse carina absent; anterior area moderately long and quite strongly impressed, striate; spiracular area fairly short, almost smooth; posterior area irregularly reticulately wrinkled; lateral longitudinal carina from complete to weak and discontinuous, usually not joined to spiracular margin by a strong, short carina though sometimes a weak one may be present and rarely it may be well developed.

Fore wing length 11–13 mm; discosubmarginal cell as in Fig. 289; AI = 0.75–1.00; CI = 0.18–0.37; ICI = 0.38–0.51; SDI = 1.07–1.27; *cu-a* slightly proximal to the base of *Rs&M*; marginal cell proximally rather sparsely hirsute, sometimes with a glabrous area; 1st subdiscal cell with distal 0.6 hirsute, especially centrally. Hind wing with 5–7 hamuli on *R*1; 1st abscissa of *Rs* straight, 2nd abscissa more or less straight.

Fore leg with tibia subcylindrical, without obvious spines on outer surface, or with very slender, scattered spines. Mid leg with longer tibial spur 1.4–1.5 times length of the shorter. Hind leg with coxa in profile 1.7–1.9 times as long as deep; trochantellus dorsally 0.1 times as long as broad; 4th segment of tarsus 2.7–2.9 times as long as broad; claws of female moderately long, apically strongly curved, with rather stout long pectinae; claws of male similar but with short pectinae.

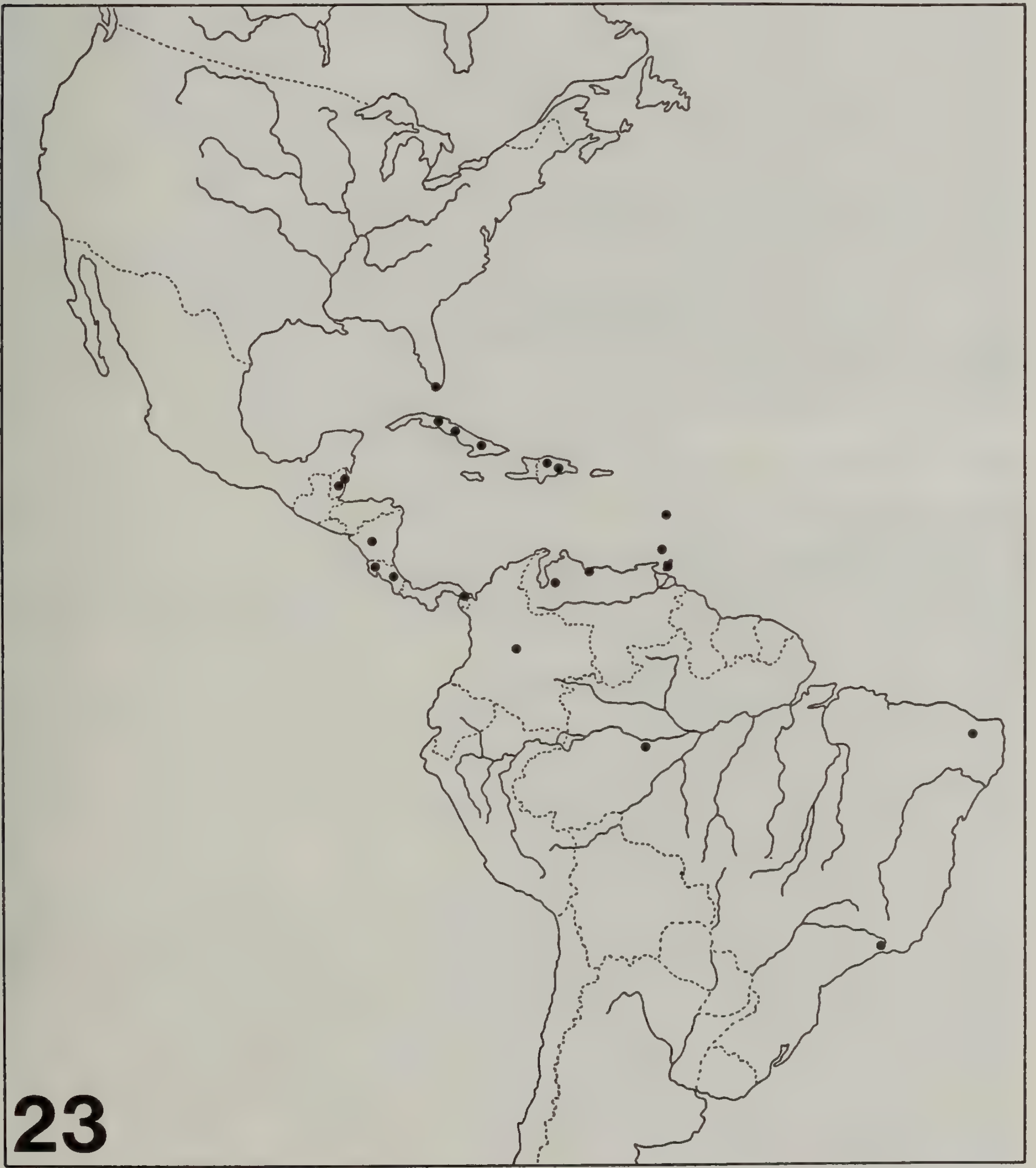
Gaster slender; tergite 2 in profile 5 or more times as long as posteriorly deep, laterotergite turned under, thyridia elliptical and separated from anterior margin of tergite by about 3 or more times its own length. Ovipositor slender, its sheath fairly narrow. Male with sternites 7–9 bearing scattered erect pubescence; gonosquama distally rounded.

Colour generally brownish orange with paler stripes on mesoscutum; interocellar area and tergites 5+ of gaster black; antenna proximally reddish brown, distally infuscate; pterostigma orange brown; wings hyaline.

VARIATION. Some of the Caribbean specimens are paler yellowish in colour and have a bright yellow scutellum. Specimens from Belize all have the terminal segments of the gaster slightly infuscate, not black as do most individuals. The distal sclerite is usually confluent with the proximal sclerite but evanescent before reaching the level of the central sclerite. In a few individuals it is continued just distal to level of central sclerite.

Remarks. *Enicospilus fernaldi* is easily recognized by the rather characteristic colour pattern – black interocellar area and tip of the gaster. Its head, in dorsal view, is slightly more quadrate than most other species. Structurally *E. fernaldi* most closely resembles *E. flavus* and *E. corcovadoi*, but can be separated from either by the form of the alar sclerites (compare Figs 283, 289, 290).

Biological Information. *Enicospilus fernaldi* is a widespread species whose range extends from the southern tip of Florida, south throughout the Caribbean to Trinidad, and from Mexico south to central Brazil (Map 23). It has been collected most frequently on some Caribbean islands, where it seems to be one of the commoner species of the genus. *E. fernaldi* is much less frequently collected on the Central American mainland. For example, in Costa Rica extensive collecting has yielded only two individuals in



Map 23 Localities at which *Enicospilus fernaldi* has been collected.

Santa Rosa National Park, a female in July 1982 and another female the following year in May, a male from Cerro el Hacha, and a single specimen from Turrialba. No specimens were collected on Barro Colorado Island, Panama, despite extensive sampling in lowland forest. The hosts of this species are unknown.

MATERIAL EXAMINED

Lectotype ♀, **Dominican Republic**: San Francisco (in mountains near San Cristobal) ix.1905 (*Busck*) (USNM); paralectotypes: 1 ♂, 1 ♀, same data as lectotype (USNM).

Belize: 1 ♀, Coyo Dist., Camp Sibim, v.1963 (CNC); 1 ♀, Punta Gordas, vii.1935 (*White*) (BMNH); 1 ♀, Río Grande, xi.1935 (*White*) (BMNH); 1 ♀, Río Temas, 1935 (*White*) (BMNH). **Brazil**: 1 ♀, Amazonas, Ducke Res., 25 km E. of Manaus, iii.1973 (*Tyson*) (CNC); 1 ♀, Ceara, Barbalha, 400 m, v.1969 (*Alvarenga*) (TC); 4 ♀, Guanabara, Represa Río Grande, v.1967 (*Alvarenga*) (TC). **Colombia**: 1 ♀, Meta, Villavicencio, 450 m, 1936 (*Bequaert*) (MCZ). **Costa Rica**: Cartago Prov.: 1 ♂, Turrialba, viii.1977 (*Hansen*) (CNC): Guanacaste Prov.: 1 ♂, Cerro el Hacha, 3–400 m, i-iv.1987 (*Janzen & Hallwachs*) (BMNH); 2 ♀, Santa Rosa National Park, 300 m, vii.1982, v.1983 (*Janzen & Hallwachs*) (BMNH). **Cuba**: 1 ♀, Baragua, x.1928 (*Rambousen*) (MCZ); 1 ♀, Cienfuegos, Soledad, Limones Seboruco, ix.1930 (*Dow*) (MCZ); 3 ♀, Cienfuegos, Soledad, Vilches Potrero, viii-ix.1930 (*Dow*) (MCZ); 2 ♂, Pinard R. ix.1913 (USNM); 2 ♀, Santa Clara, San Blas, viii.1932 (*Leavitt*) (MCZ); 1 ♀, Santa Clara, San José, Trinidad Mts, viii.1930 (*Dow*) (MCZ); 2 ♂, 2 ♀, 7 km N. of Viñales, ix.1913 (USNM). **Dominica**: 1 ♂, 1 ♀, Clarke Hall, xii.1964-i.1965 (*Spangler & Wirth*) (USNM); 1 ♀, Roseau, vi.1911 (MCZ). **Dominican Republic**: 4 ♀, Altagracia, Nisibon, v.1978 (*Fairchild*) (FSCA); 1 ♂, Greenhill Est., vii.1941 (*Fennah*) (USNM). **Grenada**: 2 ♀, Saint Georges Parish, Grand Anse, ii.1977 (*Tanaka*) (CAS). **Mexico**: 2 ♀, Jesus Carranza, viii.1939 (*Townes*) (TC). **Nicaragua**: 1 ♀, Zelaya, El Recreo, x.1964 (MCZ). **Panama**: 1 ♀, Darién, 1967 (*Triplehorn*) (TC). **Trinidad**: 2 ♀, Caroni R., xi.1952 (*Simmonds*) (CNC); 1 ♀, Curepe, x.1952 (*Simmonds*) (CNC); 2 ♀, Orange Grove, x.1952 (*Simmonds*) (CNC); 1 ♀, San Juan, x.1952 (*Simmonds*) (CNC); 2 ♀, no further data (*Voogd*) (RNH). **U.S.A.**: Florida: 1 ♀, Monroe Co., No Name Key, xii.1972 (*Dodge*) (FSCA). **Venezuela**: 1 ♀, San Esteban, nr Puerto Cabello, xi.1939 (*Anduze*) (TC); 1 ♀, Zulia, Tucuco, iv.1981 (*Townes*) (TC).

Enicospilus flavus (Fabricius)

(Figs 290, 341)

Ichneumon flavus Fabricius, 1775: 341. Lectotype ♀, 'AMERICA', designated by Townes & Townes (1966: 178) (Kiel).

Ophion flavus (Fabricius) Fabricius, 1798: 236.

Ichneumon flavarius Thunberg, 1822: 262. [Unnecessary replacement name.]

Ophion concolor Cresson, 1865: 56. LECTOTYPE ♂, CUBA, here designated (PANS) [examined]. [Synonymized by Townes *in* Wolcott, 1948: 765.]

Ophion concolor Cresson; Fox, 1891: 337.

Enicospilus concolor (Cresson) Ashmead, 1900b: 271.

Enicospilus guyanensis Cameron, 1911: 179. Holotype ♀, GUYANA (BMNH) [examined]. [Synonymized by Morley, 1914: 409.]

Enicospilus flavus (Fabricius); Hooker, 1912: 71. [In part.]

Henicospilus concolor (Cresson) Morley, 1912: 33.

Henicospilus flavoscutellatus var. *concolor* (Cresson); Enderlein, 1921: 82.

Enicospilus concolor (Cresson); Walcott, 1923: 65.

Henicospilus concolor (Cresson); Ogilvie, 1928: 48.

Enicospilus flavus (Fabricius); Townes & Townes, 1966: 178.

DESCRIPTION. Mandibles of moderate length, quite strongly narrowed, apically twisted 25–40°; upper mandibular tooth subcylindrical, 1.2–1.5 times as long as the lower tooth; outer mandibular surface weakly convex, but with a distinct proximal concavity. Labrum 0.2 times as long as broad; malar space 0.2–0.3 times as long as basal mandibular width. Clypeus in profile weakly convex, margin blunt to moderately sharp, not impressed; clypeus in front view 1.2–1.4 times as broad as long, its margin truncate to weakly convex. Lower face 0.6–0.7 times as broad as long, finely punctate laterally, centrally with traces of punctostriation. Head in dorsal view with genae strongly constricted behind eye; posterior ocellus very close to eye; FI = 60–65%; occipital carina mediodorsally complete, ventrally curved to join hypostomal carina about 0.8–1.0 times the basal mandibular width away from mandible. Antenna moderately slender, with 55–59 flagellar segments; 20th segment 2.2–2.3 times as long as broad.

Mesoscutum polished with inconspicuous punctures, in profile evenly rounded; notauli absent. Mesopleuron weakly polished, the upper part quite closely punctate, grading ventrally to punctostriate, the lower part punctostriate to striate; epicnemial carina curved towards anterior margin of pleuron. Scutellum in profile weakly convex, laterally carinate for all of its length; scutellum in dorsal view 1.5–1.6 times as long as anteriorly broad, polished, usually rather smooth, sometimes with a few striae posteriorly. Metapleuron moderately convex, punctate, rarely in a few individuals grading to punctostriate; submetapleural carina evenly anteriorly broadened; posterior transverse carina of mesosternum complete. Propodeum in profile fairly evenly declivous; anterior transverse carina usually complete, posterior transverse carina absent; anterior area strongly impressed, striate; spiracular area moderately long, smooth; posterior area reticulate; lateral longitudinal carina usually complete, usually joined to spiracular margin by a short carina.

Fore wing length 11–14 mm; discosubmarginal cell as in Figs 290, 341; AI = 0.66–1.13; CI = 0.18–0.41; ICI = 0.55–0.68; SDI = 1.14–1.33; *cu-a* proximal to the base of *Rs&M* by 0.1–0.3 times its own length; marginal cell proximally uniformly hairy; 1st subdiscal cell with distal 0.8 hirsute. Hind wing with 5–7 hamuli on *R*1; 1st abscissa of *Rs* straight, 2nd abscissa weakly arcuate.

Fore leg with tibia weakly flattened, with isolated spines on outer surface. Mid leg with longer tibial spur 1.3–1.5 times length of the shorter. Hind leg with coxa in profile 1.8–1.9 times as long as deep; trochantellus dorsally 0.1–0.2 times as long as broad; 4th segment of tarsus 2.7–3.1 times as long as broad; claws of female moderately long, apically strongly curved, with long stout pectinae; claws of male similar but with pectinae slightly shorter.

Gaster slender; tergite 2 in profile 5 or more times as long as posteriorly deep, laterotergite turned under, thyridia elliptical and separated from anterior margin of tergite by about 3 or more times its own length. Ovipositor slender, its sheath very narrow. Male with sternites 7–9 bearing scattered long erect hairs; gonosquama distally elongately rounded.

Colour generally uniformly orange-brown; interocellar area from black to brownish, contrasting with remainder of vertex; antenna reddish orange; pterostigma yellowish orange; wings hyaline.

VARIATION. This species shows considerable variation in the sculpture of the lateral parts of the alitrunk. The metapleuron may be regularly and rather sparsely punctate, closely punctate or even coarsely punctostriate, almost grading to striate. This range of variation can occur within apparently a single population (e.g. the Anguilla sample), but is most pronounced in the Caribbean examples. Most mainland South American species have the metapleuron punctate.

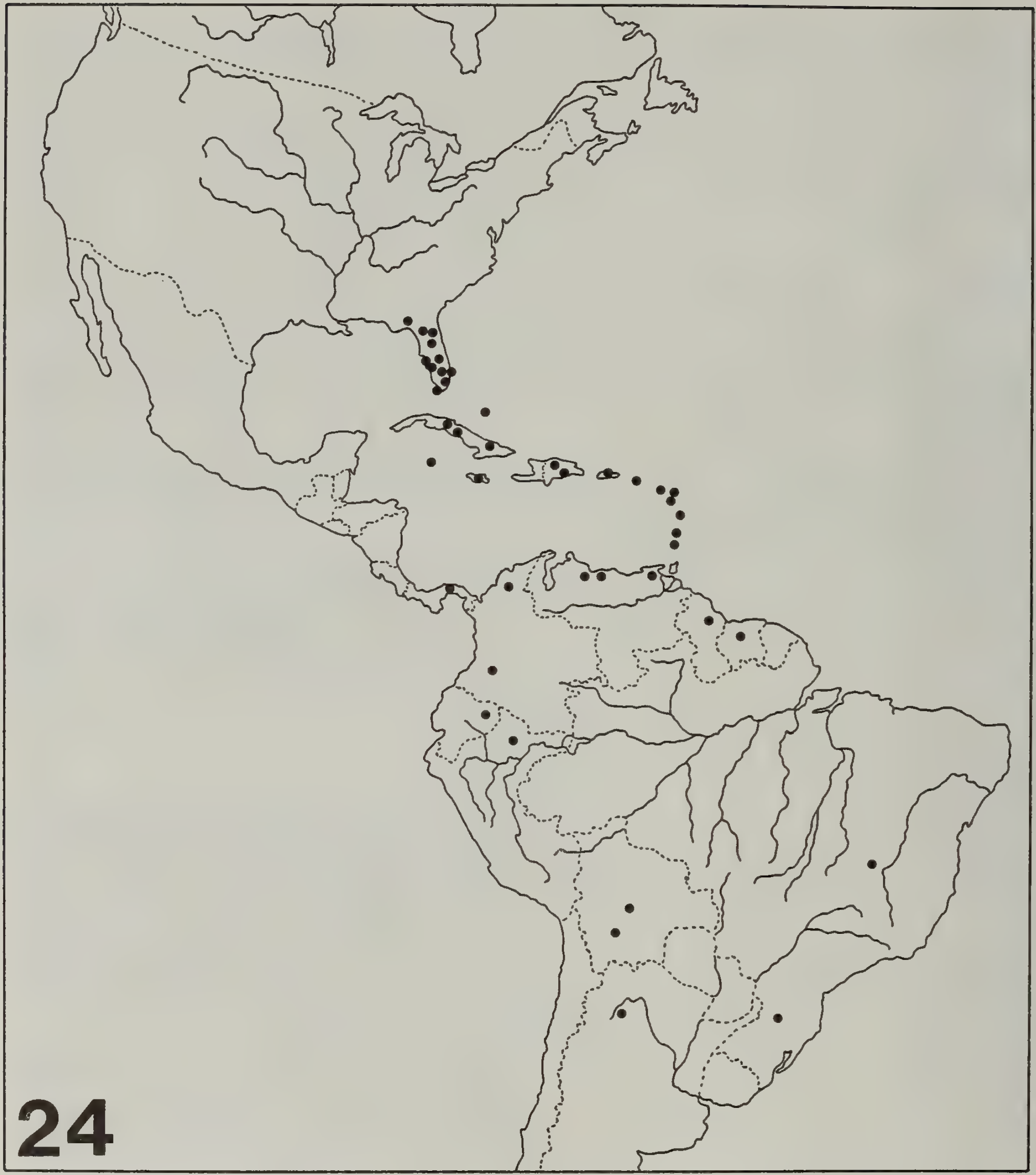
One or two individuals, including the lectotype of *E. concolor*, have the interocellar area yellowish brown, and only infuscate adjacent to the posterior ocelli.

REMARKS. In PANS there are three syntypic specimens (76–1, 76–2 and 76–3) determined by Cresson as '*Ophion concolor*'. The first is a male, and this was labelled as 'type' by Cresson. The remaining two specimens (both females) were labelled as paratypes. In 1916 Cresson (invalidly) designated lectotypes for a large number of his species; he listed each species together with the sex of the lectotype. However, in the case of *E. concolor* alone the sex symbol was omitted; presumably this was a printer's error and I believe Cresson intended to designate the male as lectotype. Townes & Townes (1966) state that the lectotype (which they acknowledge as being designated by Cresson) is female. Perhaps this mistake arose from reading the entry above *concolor* (*Ophion*), which is *concolor* (*Mesoleptus*) for which the lectotype sex is given as female. Whatever, Cresson's blanket designation of lectotypes in invalid under Article 74(c) of the *Code*. I hereby select as lectotype the male labelled as 'type' by Cresson (76–1).

In the literature published between 1837 and 1948 there are many references to *E. flavus* (see Townes & Townes, 1966), but a large proportion are almost certainly misidentifications of *E. trilineatus*. This latter species was figured in three publications (Guérin-Méneville & Pecheron, 1835; Cameron, 1886; Cushman, 1947) under the name *flavus*. When I examined the collection in the United States National Museum I discovered that virtually all the specimens determined as *E. flavus* were in fact *E. trilineatus*.

E. flavus is rather similar to and can be confused with *E. fernaldi*. The most obvious differences are in the form of the alar sclerites. The central sclerite of *E. fernaldi* is more nearly circular and larger with its longest axis at 90° to *Rs+2r* (Fig. 289); that of *E. flavus* is smaller, more elliptical with its longest axis subtending an angle of about 70° to *Rs+2r* (Fig. 290). The marginal cell of *E. flavus* is uniformly finely and closely hirsute whilst that of *E. fernaldi* is more coarsely hirsute and is proximally far less densely pubescent than it is centrally. The mandibles of the two species are quite different, though this difference is difficult to appreciate unless both species are at hand. The upper mandibular tooth of *E. fernaldi* is definitely depressed, whilst that of *E. flavus* is more cylindrical. *E. fernaldi* lacks the basal concavity possessed by the mandible of *E. flavus*, but has the distal part of the outer face concave, not slightly convex as in *E. flavus*.

BIOLOGICAL INFORMATION. *Enicospilus flavus* is widely distributed from Florida south throughout the Caribbean and thence southwards into South America as far south as northern Argentina (Map 24). In Central America it apparently only extends northwards to the Isthmus of Panama. Despite extensive



Map 24 Localities at which *Enicospilus flavus* has been collected.

collecting I have not found it to be present in Costa Rica. The records of *E. flavus* from Mexico, Guatemala and Nicaragua seem to be based on specimens of *E. trilineatus* and I have seen no authentic specimens of *E. flavus* from these countries. Although it is extremely widely distributed throughout much of the Neotropical region, *E. flavus* appears to be most common on the islands of the Caribbean. On many islands it is the most commonly collected species of the genus.

E. flavus appears to be most common in open habitats, and it has been described as 'abundant in grass' in Puerto Rico (Walcott, 1923).

MATERIAL EXAMINED

Lectotype ♂ (*Ophion concolor* Cresson), **Cuba** (PANS); paralectotypes 2 ♀, same locality (PANS).

Holotype ♀ (*Enicospilus guyanensis* Cameron), **Guyana** (BMNH).

38 ♂, 57 ♀, from the following localities - **Anguilla; Argentina** (Tucumán); **Bahamas** (Long Island); **Bolivia** (Chapare, Santa Cruz); **Brazil** (Bahia, Santa Catarina); **Cayman Islands** (Grand Cayman); **Colombia** (Atlantico, Valle); **Cuba; Dominica; Dominican Republic; Ecuador** (Napo, Pichincha); **Grenada; Guyana; Haiti; Jamaica; Monserrat; Panama** (Canal Zone); **Peru** (Loreto, Quiroz); **Puerto Rico; Saint Kitts & Nevis** (Nevis); **Saint Lucia; Saint Vincent; Surinam; U.S.A.** (Florida – Alachua, Broward, Dade, Highlands, Lee, Leon, Manatee, Marion, Monroe, Palm Beach, Putnam and Suwannee counties); **Venezuela; Virgin Islands** (BMNH, CAS, CNC, FSCA, MCZ, TC, USNM).

This species has also been recorded from Bermuda (Ogilvie, 1928) and Paraguay (Schrottky, 1913), but in view of its widespread misidentification these records require confirmation.

Enicospilus monticola (Cameron)

(Figs 186, 291, 292, 293, 310)

Ophion (*Enicospilus*) *monticola* Cameron, 1886: 292. Lectotype ♀, GUATEMALA (BMNH), designated by Townes & Townes (1966: 182) [examined].

Henicospilus monticola (Cameron) Dalla Torre, 1901: 182.

Henicospilus elegans Szépligeti, 1906: 146. Lectotype ♀, BRAZIL (TM), designated by Townes & Townes (1966: 177) [examined]. **Syn. n.**

Henicospilus fuscipennis Szépligeti, 1906: 147. Lectotype ♀, BOLIVIA (TM), designated by Townes & Townes (1966: 180) [examined]. **Syn. n.**

Enicospilus fuscipennis (Szépligeti) Hooker, 1912: 58, 89.

Enicospilus monticola (Cameron) Hooker, 1912: 64.

Enicospilus elegans (Szépligeti) Hooker, 1912: 88.

[*Henicospilus nigricornis* (Brullé) Morley, 1912: 34. Misidentification.]

Henicospilus antomelas Enderlein, 1921: 35. Holotype ♀, COLOMBIA (IZPAN) [examined]. **Syn. n.**

Enicospilus antomelas (Enderlein) Townes & Townes, 1966: 174.

DESCRIPTION. Mandibles moderately long, proximally strongly constricted and with a well-developed proximoventral lobe, distally weakly narrowed, apically twisted 45–65°; upper mandibular tooth cylindrical, 1.3–1.7 times as long as the lower tooth; outer mandibular surface finely pubescent, more or less flat. Labrum 0.2–0.3 times as long as broad; malar space 0.3–0.4 times as long as basal mandibular width. Clypeus in profile weakly convex, margin usually blunt; clypeus in front view 1.2–1.5 times as broad as long, with margin apically weakly convex. Lower face 0.55–0.65 times as broad as long, finely punctate. Head in dorsal view with genae evenly constricted behind eyes; posterior ocellus contiguous with eye; FI = 75–80%; occipital carina mediodorsally complete, ventrally curved to join hypostomal carina about 0.6–0.8 times the basal mandibular width away from mandible. Antenna slender, with 59–62 flagellar segments; 20th segment 1.7–2.4 times as long as broad.

Mesoscutum rather weakly polished, with fine inconspicuous punctures, in profile evenly rounded; notauli vestigial. Mesopleuron polished, the upper part finely punctate or rarely punctostriate, the lower part from finely punctate to punctostriate; epicnemial carina usually slightly inclined towards anterior margin of pleuron, often with upper end evanescent, and most frequently with lower corner somewhat produced as a weak tubercle (Fig. 189). Scutellum in profile weakly convex, laterally carinate for 0.7 or more of its length; scutellum in dorsal view 1.5–1.7 times as long as anteriorly broad, from smooth with fine punctures to wrinkled. Metapleuron moderately strongly convex, generally diagonally striate, sometimes with strong diagonal rugae present posterodorsally, sometimes with anteroventral region punctate, at the most extreme almost entirely punctate, with traces of striae or rugae anterodorsally; submetapleural carina quite broad anteriorly; posterior transverse carina of mesosternum from complete to centrally weak and even sometimes broadly discontinuous medially. Propodeum in profile fairly abruptly declivous; anterior transverse carina complete or with lateral extremities evanescent, posterior transverse carina usually absent, in largest specimens sometimes represented by weak lateral crests; anterior area moderately long, strongly impressed, striate or coriaceous; spiracular area fairly short, generally smooth or sometimes finely punctate; posterior area reticulate to somewhat concentrically rugose, sometimes with traces of lateral crests or a median longitudinal wrinkle; lateral longitudinal carina usually complete, sometimes indistinct posteriorly, joined to spiracular margin by a short carina.

Fore wing length 15–19 mm; discosubmarginal cell as in Figs 291–293, 310; AI = 0.86–1.61; CI = 0.21–0.46; ICI = 0.35–0.55; SDI = 1.07–1.44; *cu-a* proximal to the base of *Rs&M* by 0.1–0.3 times its own length; marginal cell usually proximally evenly hirsute; 1st subdiscal cell with anterior and distal margins broadly hirsute. Hind wing with 6–7 hamuli on *R*1; 1st abscissa of *Rs* straight, 2nd abscissa weakly curved.

Fore leg with tibia slightly flattened, with numerous slender spines on outer surface. Mid leg with longer tibial spur 1.4–1.5 times length of the shorter. Hind leg with coxa in profile 1.7–1.9 times as long as deep; trochantellus dorsally 0.1 times as long as broad; 4th segment of tarsus 2.4–2.7 times as long as broad; claws of female moderately long, distally abruptly curved, with close long pectination; claws of male similar, but with slightly shorter closer pectination.

Gaster slender; tergite 2 in profile at least 5 times as long as posteriorly deep, laterotergite folded under, thyridia oval/elliptical and separated from anterior margin of tergite by at least 4 times its own length. Ovipositor slender, its sheath narrow. Male with sternites 7–9 bearing long dense erect hairs; gonosquama quite elongate, distally rounded.

Colour generally reddish brown, with gaster (usually) from tergite 3 (rarely from tergites 1 or 2) black; interocellar area black with the black area generally extending between bases of antennae and often onto lower face; antenna black, distally slightly paler, often with scapes brownish; orbits sometimes paler yellowish, and sometimes with face pallid; pterostigma black centrally; wings weakly but evenly infumate.

VARIATION. Although this species is rather uniform in general structure, it is exceptional in having three 'forms' of central sclerite. The I morph (Figs 291, 310), the most common form in Costa Rica, has the central sclerite elongate, almost I-shaped, with its longest axis positioned at 90° to *Rs+2r*. The holotype of *Enicospilus antomelas* has the sclerite of this pattern. The O morph (Fig. 293) (of which the lectotype of *E. monticola* is an example) has the central sclerite circular; generally it is very slightly smaller than the I morph. The O morph is also common in Costa Rica. The H morph (of which the lectotypes of *E. fuscipennis* and *E. elegans* are examples) has the central sclerite hastate, with an angular side (Fig. 292). This morph is relatively uncommon in Costa Rica, but it becomes more common in South America. For example, in Brazil it constitutes a majority of the material to hand. Some individuals of the H-morph (including the lectotype of *E. elegans*) have the gaster and the hind legs distal to the trochantellus entirely black.

It is questionable whether or not these morphs represent distinct species, but at present I favour the idea that they are conspecific because, despite the fact that they do not seem to intergrade, I can find no other consistent morphological difference between them. Furthermore, all seem to show a rather similar range of variation and all occur sympatrically and synchronously in some sites. Both the I and O morphs have been reared from *Gonodonta* sp. in Costa Rica

The true status of the three morphs is only likely to be resolved by further study of their biology, and it is to facilitate this (and draw attention to the problem) that I have accorded them different epithets.

There is some variation in the extent of the black marking on the gaster. Virtually all specimens have tergites 3+ black, but some have tergite 2 and even the posterior part of tergite 1 black. I have seen isolated specimens from Venezuela and Colombia with the gaster entirely black and with the hind leg distal to the trochantellus black also. A few individuals may have the interocellar area weakly infuscate and allowances for this have been made in the key.

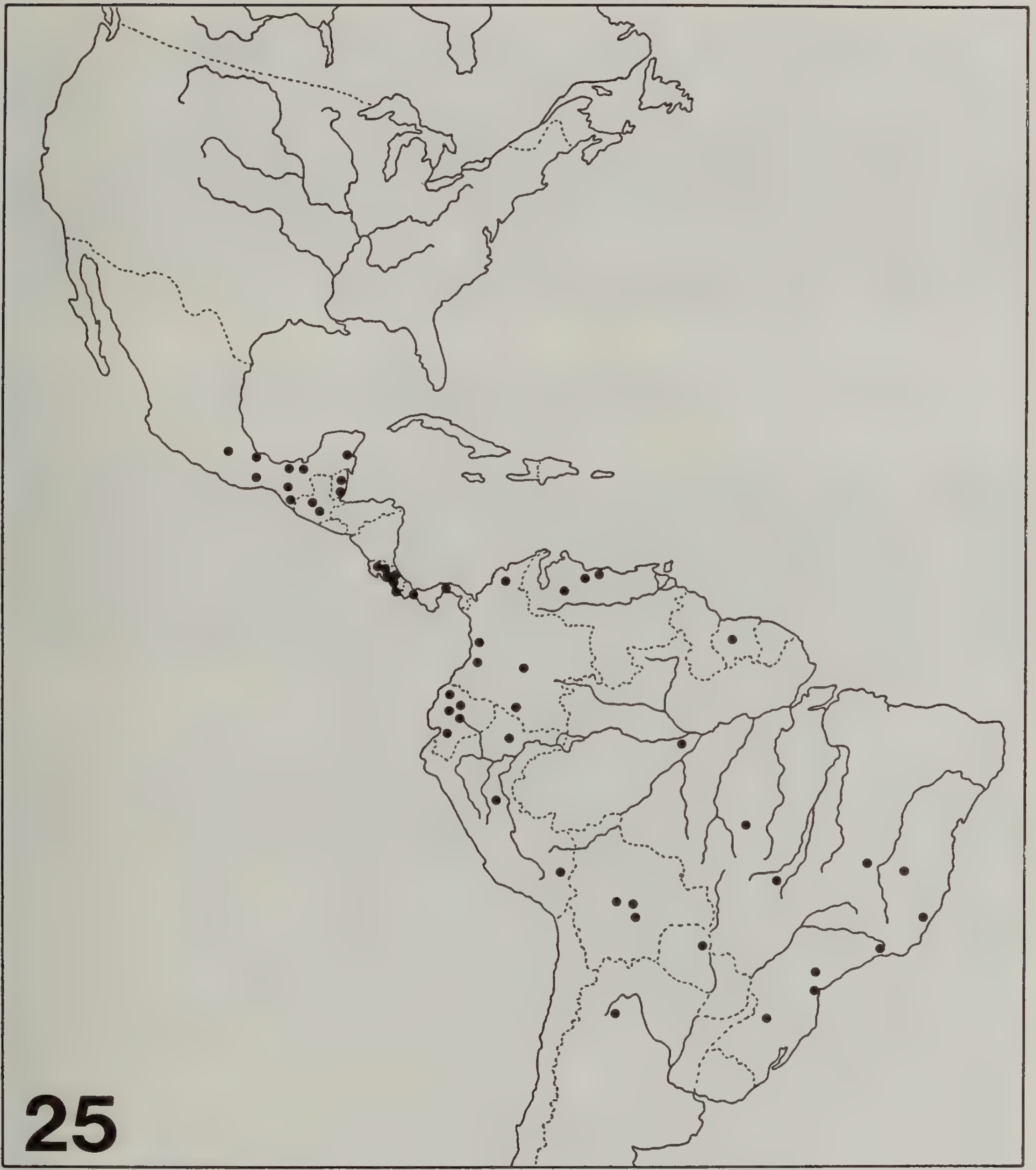
REMARKS. *Enicospilus monticola* is a rather distinctive species that, with practice, may immediately be recognized by colour alone. It is a richer reddish brown than most other species and has a glossy black gaster (at least tergites 3+), black pterostigma, interocellar area and flagellum.

BIOLOGICAL INFORMATION. *Enicospilus monticola* is a widespread species whose range extends from about 22°N in Mexico to 25°S in Brazil and northern Argentina (Map 25). As yet it has not been collected on any Caribbean island. In Mesoamerica it is one of the more commonly collected species with a black interocellar area, and it has been collected in many forested sites from sea-level up to an altitude of about 1800 m. It is frequently taken in Costa Rica, and I have seen specimens from Finca Campana, Finca San Gabriel and San Ramón Forestry Reserve in Alajuela Province; 3 km S. of Casa Mata and Turrialba in Cartago Province; Cerro el Hacha, Estacion Mengo, Rincón de la Vieja and Santa Rosa National Parks in Guanacaste Province; Tortuguero National Park in Limón Province; Corcovado National Park, Finca Las Cruces (6 km S. San Vito de Java) and Monteverde Reserve in Puntarenas Province; Braulio Carrillo National Park and San Antonio de Escazú in San José Province.

In the best-collected study site, Santa Rosa National Park, Costa Rica, *E. monticola* has frequently been collected at a light overlooking dry forest. The majority of specimens seem to fly following the start of the rainy season in May. Pooled seasonal distributional data from this site for 1980–87 are:

J	F	M	A	M	J	J	A	S	O	N	D
4	–	–	–	23	24	20	11	2	1	1	2

In Santa Rosa this species probably has several generations a year as a reared specimen [85.SRNP.396] spun a cocoon on 15 June and emerged 7 July of the same year



Map 25 Localities at which *Enicospilus monticola* has been collected.

On the Cerro el Hacha, Costa Rica, in mature dry forest, *E. monticola* is quite commonly collected between August and November. Although it has never been seen in dry forests from February through April (the very driest months of the year), it has been collected at neighbouring sites (Finca Campana and San Gabriel) and at Monteverde in February and March.

Despite intensive collecting on Barro Colorado Island, few specimens of *E. monticola* have been taken. Two were collected in May 1984 and two more in July 1985.

Two specimens have been reared in Santa Rosa National Park. Both parasitized *Gonodonta* species (Noctuidae) [81.SRNP.712; 85.SRNP.396].

Material Examined

Lectotype ♀ (*Ophion* (*Enicospilus*) *monticola* Cameron), **Guatemala**: Las Mercedes, 1000 m (*Champion*) (BMNH). Holotype ♀ (*Henicospilus antomelas* Enderlein), **Colombia**: Río Magdalena (IZPAN). Lectotype ♀ (*Henicospilus elegans* Szépligeti), **Brazil**: Blumenau (TM); paralectotype, 1 ♀, same data as lectotype (TM). Lectotype ♀ (*Henicospilus fuscipennis* Szépligeti), **Bolivia**: Mapiri (TM); paralectotype, 1 ♀, **Brazil**: Minas Gerais, 1897 (*Fruhstofter*) (TM).

82 ♂, 179 ♀, from the following localities- **Argentina** (Tucumán); **Belize; Bolivia** (Cochabamba, Santa Cruz); **Brazil** (Amazonas, Bahia, Espiritu Santo, Goias, Guanabara, Mato Grosso, Rio de Janeiro, Santa Catarina, São Paulo); **Colombia** (Amazonas, Choco, Meta, Putumayo, Valle); **Costa Rica** (Alajuela, Cartago, Guanacaste, Limón, Puntarenas and San José Provinces); **Ecuador** (Esmeraldas, Pichincha); **Guatemala; Mexico** (Chiapas, Oaxaca, Queretaro, Quintana Roo, Tabasco, Veracruz); **Panama** (Canal Zone, Chiriqui); **Paraguay; Peru** (Loreto, Madre de Dios); **Surinam; Venezuela** (Aragua, Yaracuy, Zulia). (BMNH, CAS, CNC, FSCA, TC, UM, USNM.)

Enicospilus madrigalae sp. n.

(Figs 187, 294)

Description. Mandibles moderately long, evenly narrowed, apically twisted 75–80°; upper mandibular tooth slender, slightly depressed, 1.4–1.7 times as long as the slightly stouter lower tooth (Fig. 187); outer mandibular surface sparsely pubescent, distally flat and with a weak proximal concavity. Labrum 0.2 times as long as broad; malar space 0.2–0.3 times as long as basal mandibular width. Clypeus in profile weakly convex, margin fairly blunt; clypeus in front view 1.3–1.4 times as broad as long, the margin weakly convex apically. Lower face 0.6–0.7 times as broad as long, smooth with very superficial, small punctures. Head in dorsal view with genae strongly constricted behind eye; posterior ocellus contiguous with eye; FI = 60–65%; occipital carina mediodorsally complete, ventrally curved to join hypostomal carina about 0.6–0.7 times the basal mandibular width away from mandible. Antenna slender, with 49–52 flagellar segments; 20th segment 1.9–2.1 times as long as broad.

Mesoscutum polished, with extremely fine close punctures, in profile strongly rounded; notauli absent. Mesopleuron polished, the upper part shallowly punctate, the lower part punctostriate to striate; epicnemial carina curved towards anterior margin of pleuron. Scutellum in profile weakly convex, laterally carinate for 0.9 or more of its length; scutellum in dorsal view 1.5–1.6 times as long as anteriorly broad, anteriorly smooth, posterior striate or wrinkled. Metapleuron weakly convex, rather weakly diagonally striate or punctostriate; submetapleural carina evenly anteriorly broadened; posterior transverse carina of mesosternum complete. Propodeum in profile abruptly declivous; anterior transverse carina more or less complete, posterior transverse carina absent; anterior area of moderate length, strongly impressed, striate; spiracular area quite long, virtually smooth; posterior area more or less transversely concentrically striate; lateral longitudinal carina usually present only anteriorly, less frequently represented by discontinuities posteriorly, not joined to spiracular margin by a short carina, or with this carina weak.

Fore wing length 12–13 mm; discosubmarginal cell as in Fig. 294; AI = 1.17–1.40; CI = 0.09–0.21; ICI = 0.45–0.61; SDI = 1.14–1.22; *cu-a* from subopposite to slightly proximal to the base of *Rs&M*; marginal cell proximally glabrous; 1st subdiscal cell with scattered isolated hairs distally. Hind wing with 5–6 hamuli on *R*1; 1st and 2nd abscissae of *Rs* straight.

Fore leg with tibia weakly flattened, with scattered spines on outer surface. Mid leg with longer tibial spur 1.7–1.8 times length of the shorter. Hind leg with coxa in profile 1.6–1.7 times as long as deep; trochantellus dorsally 0.1 times as long as broad; 4th segment of tarsus 2.2–2.6 times as long as broad; claws of female moderately long, abruptly but shortly rounded apically, with rather short, close pectinae; claws of male similar but with slightly shorter pectinae.

Gaster slender; tergite 2 in profile more than 4.5 times as long as posteriorly deep, laterotergite folded under, thyridia elliptical and separated from anterior margin of tergite by at least 3 times its own length. Ovipositor slender, its sheath moderately narrow. Male with sternites 7–9 bearing long stout erect hairs; gonosquama distally evenly rounded.

Colour generally orange, but with most of head, prothorax and mesothorax laterally paler yellow, mesoscutal vittae brownish; interocellar area black; antenna blackish, distally brown; pterostigma brownish; wings very weakly infumate.

Variation. Many specimens have the scutellum and mesoscutal stripes pale yellow.

Remarks. This species is named in honour of Liliana Madrigal in recognition of her numerous contributions to Costa Rican conservation biology.

Enicospilus madrigalae is most easily recognized by the straight vein *Rs+2r* in the fore wing, the proximally glabrous marginal cell and the characteristic central sclerite (Fig. 294). It is quite similar to *E. xanthocarpus* from which it may be separated by the characters given in the key.

BIOLOGICAL INFORMATION. *Enicospilus madrigalae* is a widely distributed species whose range extends from Guatemala south to central Brazil. It is relatively rare in collections, but this may be because the adults seem to have both a short flight season and may only be common in certain years. For example, in Santa Rosa National Park, Costa Rica, only isolated specimens were collected between 1978 and 1983, but in 1984 the species was very common. Only a few individuals were collected in 1985 and 1987, despite the fact that an intensive collecting effort was made at what should have been the height of their season. Seasonal data for 1984 are:

J	F	M	A	M	J	J	A	S	O	N	D
–	–	–	–	11	18	1	–	–	–	–	–

The only other Santa Rosa specimens collected are – vi.78 (1), vi.80(1), vii.82(1), vi.85(3) and vi.87(1). Nothing is known of the hosts of *E. madrigalae*.

MATERIAL EXAMINED

Holotype ♀, **Costa Rica**: Guanacaste Prov., Santa Rosa National Park, 300 m, vi.1984 (*Janzen & Hallwachs*) (BMNH).

Paratypes. **Brazil**: 1 ♀, Aguas Vermelhas, 800 m, xii.1983 (*Alvarenga*) (TC); 5 ♂, 21 ♀, Bahia, Encruzilhada, 960–980 m, xi.1972, xi.1973 & xi.1974 (*Alvarenga*) (TC); 1 ♂, Mato Grosso, Sinop, 12°31'S 55°37'W, x.1974 (*Alvarenga*) (TC); 3 ♀, Minas Gerais, Pedra Azul, 800 m, xi.1972 (*Alvarenga & Seabra*) (TC). **Costa Rica**: Guanacaste Prov.: 15 ♂, 19 ♀, Santa Rosa National Park, 300 m, vi.1978, vi.1980, vii.1982, v-vii.1984 & vi.1987 (*Janzen & Hallwachs*) (BMNH; CNC; MNCR; PANS); 3 ♀, same locality, vi.1985 (*Gauld*) (BMNH). **Guatemala**: 1 ♀, Moça Guatalon, 1000 m, iii-iv.1931 (*Bequaert*) (MCZ).

Enicospilus xanthocarpus (Szépligeti)

(Figs 188, 189, 295)

Henicospilus xanthocarpus Szépligeti, 1906: 146. Holotype ♀, BOLIVIA (TM) [examined].
Enicospilus xanthocarpus (Szépligeti) Hooker, 1912: 91.
Henicospilus flavosignatus Enderlein, 1921: 34. Holotype ♀, ECUADOR (IZPAN) [examined]. **Syn. n.**
Enicospilus flavosignatus (Enderlein) Townes & Townes, 1966: 178.

DESCRIPTION. Mandibles moderately long, proximally fairly strongly tapered, distally more parallel-sided, apically twisted 10–15°; upper mandibular tooth slightly depressed, 1.2–1.3 times as long as the lower tooth (Fig. 188); outer mandibular surface slightly concave, with scattered fine pubescence. Labrum 0.2 times as long as broad; malar space 0.3–0.4 times as long as basal mandibular width. Clypeus in profile weakly convex, margin blunt; clypeus in front view 1.25–1.35 times as broad as long, with the apical margin weakly convex. Lower face 0.60–0.65 times as broad as long, finely but quite closely punctate, the punctures fusing centrally to give striations. Head in dorsal view with genae strongly constricted posteriorly; posterior ocellus contiguous with eye; FI = 65–75%; occipital carina mediodorsally complete, ventrally curved to join hypostomal carina about 0.7–0.8 times the basal mandibular width away from mandible. Antenna slender, with 57–61 flagellar segments; 20th segment 2.7–2.8 times as long as broad.

Mesoscutum polished, closely and finely punctate, in profile strongly rounded; notauli vestigial. Mesopleuron polished, the upper part finely but closely punctate, the lower part rugose-striate, especially in a band from lower corner forwards to the epicnemial carina (Fig. 189); epicnemial carina curved or inclined towards but not reaching anterior margin of pleuron. Scutellum in profile weakly convex, laterally carinate for more or less all of its length; scutellum in dorsal view 1.5–1.6 times as long as anteriorly broad, often irregularly wrinkled, sometimes smooth. Metapleuron weakly convex, punctate, punctostriate or striate; submetapleural carina quite strongly but evenly broadened anteriorly; posterior transverse carina of mesosternum complete. Propodeum in profile evenly declivous; anterior transverse carina complete, posterior transverse carina absent; anterior area short and strongly impressed, striate; spiracular area quite long, smooth; posterior area centrally more or less concentrically striate, usually also with a median longitudinal ridge, rarely more evenly reticulate; lateral longitudinal carina from complete to present only anteriorly, joined to spiracular margin by a short carina.

Fore wing length 13–14 mm; discosubmarginal cell as in Fig. 295; AI = 0.85–1.36; CI = 0.22–0.34; ICI = 0.31–0.48; SDI = 1.17–1.29; *cu-a* proximal to the base of *Rs&M* by about 0.2 of its length; marginal cell proximally fairly uniformly hirsute; 1st subdiscal cell with scattered hairs distally. Hind wing with 6 hamuli on *R*1; 1st abscissa of *Rs* straight, 2nd abscissa almost straight.

Fore leg with tibia weakly flattened, with fine scattered spines on outer surface. Mid leg with longer tibial spur 1.6 times length of the shorter. Hind leg with coxa in profile 1.8–1.9 times as long as deep; trochantellus dorsally 0.1–0.4 times as long as broad; 4th segment of tarsus 2.6–2.7 times as long as broad; claws of female moderately long, evenly rounded apically, with long close pectinae; claws of male similar, but with shorter slightly closer pectination.

Gaster slender; tergite 2 in profile more than 6 times as long as posteriorly deep, laterotergite folded under, thyridia oval/elliptical and separated from anterior margin of tergite by about 4–6 times its own length. Ovipositor slender, its sheath narrow. Male with sternites 7–9 bearing long stout erect hairs; gonosquama long, distally rounded.

Colour generally orange-brown, mesoscutal vittae darker and tergites 4+ of gaster infuscate; interocellar area black, and with black markings extending down between antennal bases; antenna black, distally brownish; pterostigma brown; wings hyaline to weakly infumate.

VARIATION. This species exhibits a considerable range of morphological variation, and I am not completely certain that the Mesoamerican specimens (which are very similar to the holotype of *E. xanthocarpus*) are conspecific with the majority of the lowland South American examples (which are structurally like *E. flavosignatus*). Firstly, the Mesoamerican and a few Brazilian specimens have a fairly long hind trochantellus (0.3–0.4 times as long dorsally as broad) but many from further south have a shorter one (0.1) and also a stouter coxa. These specimens often also have a stouter lower tooth of the mandible than do Costa Rican specimens, and some have the mandible more apically twisted (up to about 30°). There is some variation in the size and degree of sclerotization of the central sclerite. In most Costa Rican specimens it is moderately sclerotized and medium-sized, but specimens from further south tend to have this sclerite slightly smaller and more strongly sclerotized. Typical examples of *E. xanthocarpus* have the metapleuron punctostriate to striate, but some Brazilian material and the holotype of *E. flavosignatus* have the matapleuron regularly punctate. However, except for these differences all the specimens are very similar to each other, and as the variation seems to be more or less continuous, I suggest that for the present *flavosignatus* is treated as a synonym of *xanthocarpus*.

REMARKS. *Enicospilus xanthocarpus* is rather similar and probably closely related to *E. kleini*. The two have similar wings and alar sclerites, though the central sclerite of *E. kleini* is usually somewhat curved. The most obvious differences between these two species is in coloration: the antennae, interocellar area and terminal gastral segments of *E. xanthocarpus* are blackish whereas in *E. kleini* they are yellowish brown. The slightly impressed, rugose/striate area present on the mesopleuron of *E. xanthocarpus* is absent in *E. kleini*, and the Costa Rican specimens of *E. kleini* have a short hind trochantellus, whereas that of Costa Rican examples of *E. xanthocarpus* is long.

BIOLOGICAL INFORMATION. *Enicospilus xanthocarpus* is a widely distributed species whose range extends from northern Costa Rica south into Paraguay and southern Brazil. Although it is a relatively commonly collected species in South America, it is much more rarely taken in Costa Rica where it has only been collected in Santa Rosa National Park. Isolated specimens have been collected at this site from the middle of the wet season to early dry season, between July and January. Nothing is known of the host range of this species.

MATERIAL EXAMINED

Holotype ♀ (*Henicospilus xanthocarpus* Szépligeti), **Bolivia**: Mapiri (TM). Holotype ♀ (*Henicospilus flavosignatus* Enderlein), Ecuador: Bucay (IZPAN).

Long trochantellar morph material. **Brazil**: 1 ♂, 3 ♀, Aguas Vermelhas, 800 m, xii.1983 (*Alvarenga*) (BMNH). **Costa Rica**: Guanacaste Prov.: 6 ♀, Santa Rosa National Park, 300 m, vii, viii, x & xi.1982, i.1984 (*Janzen & Hallwachs*) (BMNH). **Mexico**: Chiapas: 1 ♀, Muste, near Huixtla, 440 m, ix.1970 (*Welling*) (CNC).

Short trochantellar morph material. 29 ♂, 56 ♀, from – **Brazil** (Amazonas, Bahia, Goias, Guanabara, Mato Grosso, Minas Gerais, Pará, Rio de Janeiro, Santa Catarina, São Paulo); **Colombia** (Amazonas, Magdalena, Valle); **Panama; Paraguay; Peru** (Loreto); **Surinam.**

Enicospilus duckworthi sp. n.

(Figs 185, 190, 296)

DESCRIPTION. Mandibles moderately long, proximally strongly tapered, distally more weakly narrowed, apically twisted 30–40°; upper mandibular tooth cylindrical, 1.3–1.5 times as long as the lower tooth; outer mandibular surface flat with scattered fine hairs basally. Labrum 0.3 times as long as broad; malar space 0.3–0.4 times as long as basal mandibular width. Clypeus in profile weakly convex, margin blunt; clypeus in front view 1.5–1.6 times as broad as long, with apical margin weakly convex. Lower face 0.74–0.76 times as broad as long, punctate, centrally tending to striate. Head in dorsal view with genae rounded behind eyes; posterior ocellus close to but not touching eye; FI = 55–60%; occipital carina mediodorsally complete, ventrally curved to join hypostomal carina about 0.9 times the basal mandibular width away from mandible. Antenna long and slender, with 50–52 flagellar segments; 20th segment 2.2 times as long as broad.

Mesoscutum polished, finely punctate, in profile evenly rounded; notauli vestigial. Mesopleuron polished, the upper and lower parts finely punctate, ventrally sometimes punctostriate; epicnemial carina inclined towards anterior margin of pleuron (Fig. 185), its upper end usually evanescent. Scutellum in profile weakly convex, laterally carinate for all of its length; scutellum in dorsal view 1.8 times as long as anteriorly broad, anteriorly punctate, posteriorly slightly wrinkled. Metapleuron rather weakly convex, with coarse shallow punctures that tend to coalesce irregularly so in some individuals the metapleuron is irregularly wrinkled (Fig. 190); submetapleural carina evenly anteriorly broadened; posterior transverse carina of mesosternum complete. Propodeum in profile evenly declivous; anterior transverse carina complete, posterior transverse carina absent; anterior area short, strongly impressed, slightly rugose; spiracular area moderately long, smooth; posterior area finely reticulate; lateral longitudinal carina present anteriorly but weak, not joined to spiracular margin by a short carina.

Fore wing length 14–16 mm; discosubmarginal cell as in Fig. 296; AI = 0.87–1.00; CI = 0.32–0.40; ICI = 0.53–0.57; SDI = 1.09–1.15; *cu-a* opposite or proximal to the base of *Rs&M* by less than its own thickness; marginal cell proximally narrowly glabrous to evenly hirsute; 1st subdiscal cell centrally and distally hirsute. Hind wing with 6–7 hamuli on *R*1; 1st abscissa of *Rs* weakly curved, 2nd abscissa virtually straight.

Fore leg with tibia slightly flattened, with scattered fine spines on outer surface. Mid leg with longer tibial spur 1.5–1.7 times length of the shorter. Hind leg with coxa in profile 1.7–1.8 times as long as deep; trochantellus dorsally 0.1 times as long as broad; 4th segment of tarsus 2.1–2.2 times as long as broad; claws of female quite long and evenly curved, with close stout pectinae.

Gaster long and slender; tergite 2 in profile more than 6 times as long as posteriorly deep, laterotergite up-turned, thyridia elliptical and separated from anterior margin of tergite by about 3 or more times its own length. Ovipositor moderately stout, its sheath slender. Male unknown.

Colour generally orange-brown with tergites 3+ of gaster black, gastral segments 3 and 4 ventrally pallid; interocellar area black; antenna blackish; pterostigma dark brown; wings weakly infumate.

VARIATION. The holotype is slightly darker in colour than any of the paratypes, but structurally all are very alike.

REMARKS. This species is named in honour of Donald Duckworth in recognition of his many contributions to tropical entomology.

Enicospilus duckworthi is a very distinctive species on account of its characteristic alar sclerites (see Fig. 296). The second discal cell in the fore wing is slightly deeper and 1*m-cu* seems more sinuate than other species which key out near this one. The phylogenetic relationships of this species are unclear.

BIOLOGICAL INFORMATION. *Enicospilus duckworthi* is a widely distributed species whose range extends from Panama south to Bolivia. It has not been collected in the lowlands of eastern South America, and from the very limited data to hand, it seems to occur in mid altitude forests between 1100 and 2200 m. The hosts of this species are unknown.

MATERIAL EXAMINED

Holotype ♀, **Panama**: Cerro Campana, nr Chica, iv.1965 (*Duckworth & Duckworth*) (USNM).

Paratypes. **Bolivia**: 1 ♀, Chapare, Alto Palmar, 1100 m, ii.1961 (CNC); 1 ♀, Chapare, El Limbo, 2200 m, i.1962 (CNC). **Colombia**: 1 ♀, Cundinamarca, Monteredondo, iv.1961 (*Foerster*) (TC).

Enicospilus devriesi sp. n.

(Fig. 297)

[*Henicospilus trimaculatus* (Taschenberg); Morley, 1912: 35, in part. Misidentification.]

DESCRIPTION. Mandibles quite long, rather evenly narrowed proximally and somewhat parallel-sided distally, apically twisted 10–20°; upper mandibular tooth subcylindrical, 1.3–1.4 times as long as the lower tooth; outer mandibular surface centrally rather flat, without a discernible proximal concavity. Labrum 0.2–0.3 times as long as broad; malar space 0.3–0.4 times as long as basal mandibular width. Clypeus in profile moderately convex, margin inturned, usually very narrowly impressed; clypeus in front view 1.4–1.6 times as broad as long, margin weakly convex. Lower face 0.65–0.70 times as broad as long, usually polished, with scattered weak punctures. Head in dorsal view with genae constricted behind the eyes; posterior ocellus very close to the eye; FI = 70–75%; occipital carina mediodorsally complete, ventrally curved to join hypostomal carina about 0.9 times the basal mandibular width away from mandible. Antenna long and slender with 59–62 flagellar segments; 20th segment 2.0–2.3 times as long as broad.

Mesoscutum polished, with shallow sparse punctures, in profile steeply rounded anteriorly; notauli vestigial. Mesopleuron highly polished, the upper part with fine inconspicuous scattered punctures, the lower part similar though sometimes smoother; epicnemial carina very strong and often crenulate behind, curved towards anterior margin of pleuron, usually with upper end reaching a small scabrous patch. Scutellum in profile weakly convex, laterally carinate for anterior 0.2–0.4 of its length; scutellum in dorsal view 1.5–1.6 times as long as anteriorly broad, relatively smooth. Metapleuron polished, smooth except for minute scattered punctures; submetapleural carina barely broadened anteriorly; posterior transverse carina of mesosternum complete. Propodeum in profile quite long, evenly declivous; anterior transverse carina complete, posterior transverse carina sometimes represented by lateral vestiges; anterior area moderately long, shallow, striate; spiracular area long, smooth; posterior area from irregularly reticulate to relatively smooth, somewhat alutaceous, often with a weak median longitudinal ridge; lateral longitudinal carina generally complete, joined to spiracular margin by a short carina.

Fore wing length 13–17 mm; discosubmarginal cell as in Fig. 297; AI = 0.42–0.68; CI = 0.29–0.39; ICI = 0.33–0.45; SDI = 1.20–1.33; *cu-a* proximal to the base of *Rs&M*; marginal cell proximally uniformly hirsute; 1st subdiscal cell with anterior and distal parts extensively hirsute. Hind wing with 6–7 hamuli on *R*1; 1st abscissa of *Rs* straight, 2nd abscissa from almost straight to slightly sinuous.

Fore leg with tibia slightly flattened, with scattered fine spines on outer surface. Mid leg with longer tibial spur 1.2–1.4 times length of the shorter. Hind leg with coxa in profile 1.9–2.1 times as long as deep; trochantellus dorsally 0.3–0.6 times as long as broad; 4th segment of tarsus 2.2–2.4 times as long as broad; claws of female quite large, with moderately short, fairly closely spaced pectinae, those of male similar.

Gaster slender; tergite 2 in profile at least 5 times as long as posteriorly deep, laterotergite upturned, thyridia elliptical and separated from anterior margin of tergite by about 4 times its own length. Ovipositor slender, its sheath narrow. Male with sternites 7–9 bearing long, relatively fine, semierect pubescence; gonosquama evenly rounded.

Colour generally pale yellowish, with mesoscutal vittae, mesosternum, anterior part of propodeum infuscate; gaster pale yellow with hind part of tergites 1–3 and most of tergites 4+ infuscate so that anterior part of gaster appears to be banded; interocellar area yellowish; antenna golden; pterostigma yellow; wings hyaline.

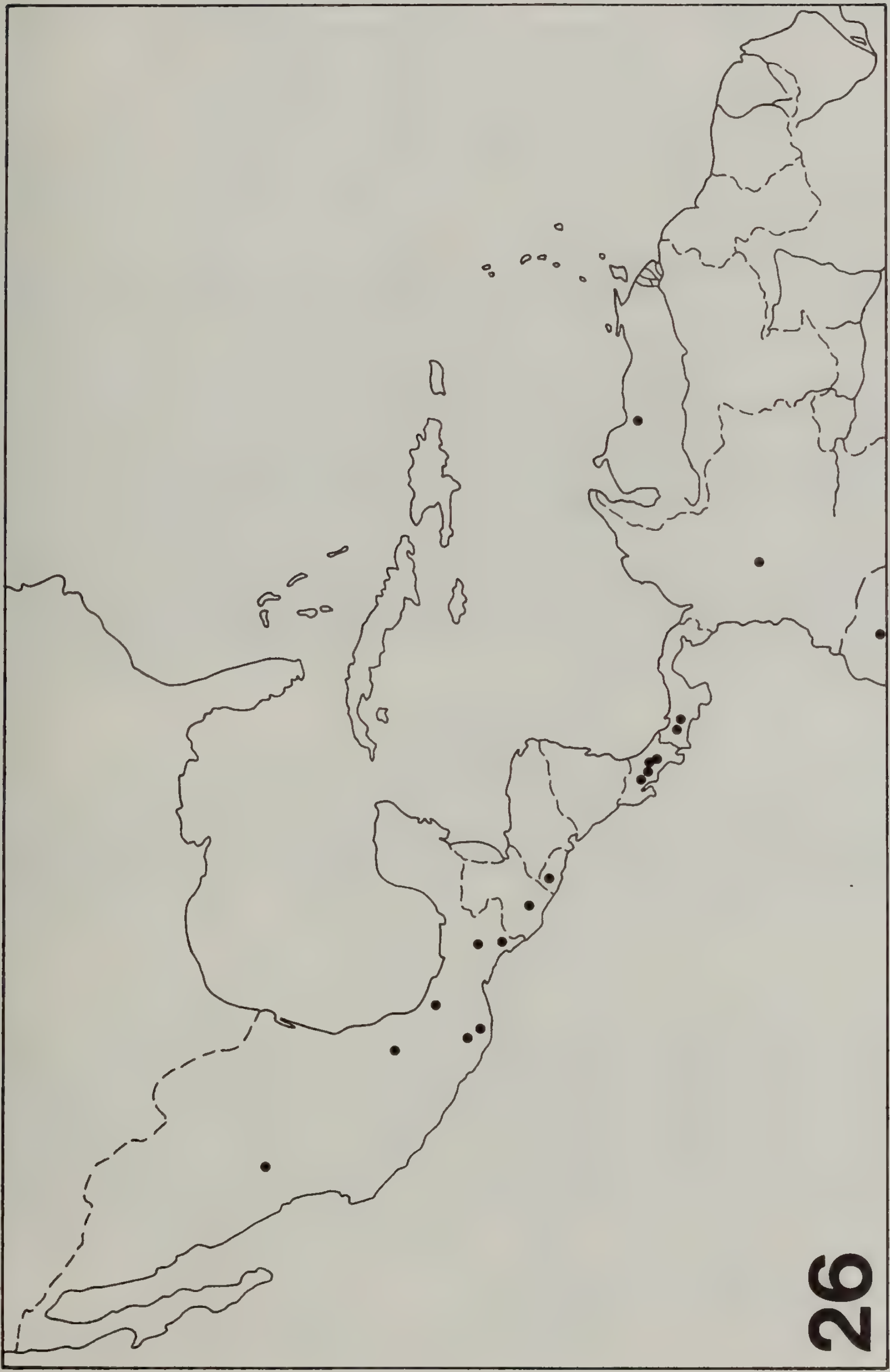
VARIATION. There is some variation in the degree of integumental infuscation. Many specimens have the lower part of the mesopleuron extensively infuscate; some also have the hind coxa blackish brown.

REMARKS. This species is named in honour of Phil DeVries in recognition for his work on the Costa Rican butterfly fauna.

Enicospilus devriesi is one of the most easily recognized species of *Enicospilus* as it is the only one in Central America with two central sclerites (Fig. 297). It is also unusual in having very reduced lateral longitudinal scutellar carinae, and its colour pattern is quite distinctive. *E. devriesi* is probably closely related to *E. flavoscutellatus* as both species have similar sculpture, venation and mandibles

BIOLOGICAL INFORMATION. *Enicospilus devriesi* is a widely distributed species whose range extends from about 24°N in Mexico south through Central America and northern South America to Ecuador (3°S) (Map 26). It is relatively frequently collected in cloud forests at altitudes between 1200 and 2500 m, and has never been collected below 800 m. *E. devriesi* seems to gradually replace *E. flavoscutellatus* at altitudes above 2000 m, whilst at intermediate elevations *E. flavoscutellatus* predominates (e.g. at Monteverde, 1350 m). In Panama, at Guadalupe Arriba (2300 m), *E. devriesi* is the most commonly collected species of *Enicospilus* and accounts for about 85% of all specimens of the genus collected at light. In such habitats it occurs with several species of *Ophion*, *Sicophion fenestralis* and *Janzophion nebosus*. Its monthly occurrence at Guadalupe Arriba for 1984–5 is:

J	F	M	A	M	J	J	A	S	O	N	D
–	–	3	6	4	6	3	1	2	1	1	1



Map 26 Localities at which *Enicospilus devriesi* has been collected.

E. devriesi is comparatively less common at Monteverde, Costa Rica (1350 m). The cumulative seasonal distribution for 1962–86 is:

J	F	M	A	M	J	J	A	S	O	N	D
5	12	1	1	2	1	–	1	–	1	1	–

It is not known which insects serve as hosts for this species.

MATERIAL EXAMINED

Holotype ♀, **Costa Rica**: Alajuela Prov., San Ramón Reserve, Río San Lorencito, 800 m, ii.1987 (*Chacon & Chacon*) (BMNH).

Paratypes. **Colombia**: 1 ♀, Cundinamarca, Monterredondo, iv.1961 (*Foerster*) (CNC). **Costa Rica**: Alajuela Prov.: 1 ♂, San Ramón Forestry Reserve, 5 km N. of Col. Palmarena, 900 m, v.1985 (*Chacon*) (BMNH); 1 ♂, 2 ♀, San Ramón Reserve, Río San Lorencito, 800 m, ii-iii.1987 (*Chacon & Chacon*) (BMNH); 2 ♂, 3 ♀, Volcán Poás National Park, 2350 m, xii.1982 (*Janzen & Hallwachs*) (BMNH): Puntarenas Prov.: 1 ♂, 13 ♀, Monteverde, 1350 m, i-iii.1962 (*Palmer*) (TC); 1 ♀, same locality, ii.1984 (*Cameron*) (WC); 2 ♀, same locality, iv-v.1984 (*Gauld*) (BMNH); 1 ♀, same locality, vi.1984 (*Fogden*) (BMNH); 2 ♂, 2 ♀, same locality, xi.1985, i, v, viii.1986 (*Haber*) (BMNH; MNCR); 3 ♀, same locality, i.1986 (*Forsyth*) (CNC): San José Prov.: 1 ♂, 4 ♀, San Gerardo de Dota, Cerro de la Muerte, 2430 m, xii.1981 (*Janzen & Hallwachs*) (BMNH); 1 ♀, San Antonio de Escazú, 1300 m, v-vi.1981 (*Eberhard*) (UMC); 1 ♀, San José, i.1961 (*Palmer*) (TC). **Ecuador**: 1 ♀, N. Perucho (Ota), 2000 m, i.1971 (*Peña*) (TC). **El Salvador**: 1 ♀, Cerro Verde, 2000 m, v.1971 (*Howden*) (TC). **Guatemala**: 1 ♀, Solola, Panajachel, 1550 m, iii.1955 (*Stuart*) (UMC). **Mexico**: Chiapas: 2 ♀, 35 km NE. Huixtla, 1000 m vi.1969 (*Teskey & Mason*) (CNC); 1 ♂, 4 ♀, San Cristobal de las Casas, 2400 m, vi-vii.1969 (*Bright & Campbell*) (CNC); 1 ♀, Yerba Buena, 32 km N. Bochil, 1900 m, vi.1969 (CNC): Durango: 3 ♀, 48 km W. La Cuidad, 2200 m, vii.1964 (*Mason*) (CNC): Guerrero: 1 ♀, Amula, 2000 m, viii.1904 (*Smith*) (BMNH); 2 ♀, Chilpancingo, 1500 m, vi.1904 (*Smith*) (BMNH): Hidalgo: 1 ♀, Jacala, 1500 m, vii.1939 (*Haag*) (MCZ): Veracruz: 1 ♂, Atoyac, v.1904 (*Smith*) (BMNH). **Panama**: 1 ♀, Chiriqui, Fortuna, 1050 m, iv.1978 (*Wolda*) (RNH); 12 ♂, 16 ♀, Chiriqui, Guadalupe Arriba, 2300 m, dates as above (*Wolda*) (BMNH). **Venezuela**: 1 ♀, Aragua, Rancho Grande, iv.1960 (*Test*) (UMC).

***Enicospilus donahuei* sp. n.**

(Fig. 298)

[*Ophion* (*Enicospilus*) *flavo-scutellatus* Brullé; Cameron, 1886. Misidentification.]

DESCRIPTION. Mandibles moderately long, weakly narrowed, apically twisted 10–20°; upper mandibular tooth subcylindrical, 1.2–1.4 times as long as the lower tooth; outer mandibular surface flat, with scattered long hairs. Labrum 0.3 times as long as broad; malar space 0.3–0.4 times as long as basal mandibular width. Clypeus in profile weakly convex, margin blunt; clypeus in front view 1.45–1.55 times as broad as long, with margin weakly convex. Lower face 0.70–0.75 times as broad as long, weakly polished, centrally finely and quite closely punctate. Head in dorsal view with genae constricted behind eyes; posterior ocellus contiguous with eye; FI = 68–73%; occipital carina mediodorsally complete, ventrally curved to join hypostomal carina about 0.8–0.9 times the basal mandibular width away from mandible. Antenna long but rather stout, with 64–70 flagellar segments; 20th segment 1.8–2.1 times as long as broad.

Mesoscutum weakly polished, with very fine punctation, in profile steeply rounded; notauli vestigial. Mesopleuron moderately polished, the upper part finely and closely punctate, the lower part similar but with punctures generally weaker, and usually with weak coriaceous sculpture centrally; epicnemial carina inclined towards anterior margin of pleuron. Scutellum in profile weakly convex, laterally carinate for 0.6 or more of its length; scutellum in dorsal view 1.4–1.5 times as long as anteriorly broad, finely punctate. Metapleuron finely but rather weakly punctate; submetapleural carina evenly anteriorly broadened; posterior transverse carina of mesosternum complete. Propodeum in profile evenly declivous; anterior transverse carina complete, posterior transverse carina represented laterally by vestiges; anterior area long, shallow, with scattered striae; spiracular area smooth with some fine punctures; posterior area weakly irregularly wrinkled, with a median longitudinal wrinkle; lateral longitudinal carina complete, joined to spiracular margin by a weak short carina.

Fore wing length 19–20 mm; discosubmarginal cell as in Fig. 298; AI = 0.36–0.65; CI = 0.30–0.40; ICI = 0.39–0.51; SDI = 1.01–1.11; *cu-a* proximal to the base of *Rs&M*; marginal cell proximally uniformly hirsute; 1st subdiscal cell with anterior and distal parts densely hirsute. Hind wing with 7–11 hamuli on *R*1; 1st abscissa of *Rs* almost straight, 2nd abscissa weakly arcuate.

Fore leg with tibia noticeably flattened, with numerous spines on outer surface. Mid leg with longer tibial spur 1.3–1.4 times length of the shorter. Hind leg with coxa in profile 1.8–1.9 times as long as deep; trochantellus dorsally 0.2 times as long as broad; 4th segment of tarsus 1.7–2.0 times as long as broad; claws of female large, with close, short, slightly inwardly inclined pectinae, those of male similar.

Gaster quite slender; tergite 2 in profile at least 6 times as long as posteriorly deep, laterotergite upturned, thyridia large, oval/elliptical and separated from anterior margin of tergite by about 3 or more times its own length. Ovipositor slender, its sheath narrow. Male with sternites 7–8 bearing long stout erect hairs, which appear to be arranged in two subterminal clusters; gonosquama evenly rounded.

Colour generally yellowish, with mesoscutal vittae and posterior and dorsal parts of gastral tergites infuscate; interocellar area yellowish; antenna golden; pterostigma yellowish brown; wings very weakly infumate.

VARIATION. The specimens from Mexico are paler yellow with darker markings on the mesopleuron, mesosternum and propodeum. One individual also has a much larger alar sclerite than the other specimens, but otherwise it appears to be conspecific.

REMARKS. This species is named in honour of Julian Donahue for his enthusiastic support of Costa Rican conservation plans.

Enicospilus donahuei is easily recognized because it has part of the fenestra, inside the distal sclerite, bearing a wide band of fine pubescence (Fig. 298). Only one other species, *E. fosteri*, has part of the fenestra hirsute, and in that case it is the anterior margin of the fenestra, adjacent to *Rs+2r* that is hairy (Fig. 303). The phylogenetic affinities of this species are not known, but in colour and sculpture of the propodeum it is similar to *E. devriesi*. Possibly this is convergence because both species inhabit similar areas, and several cloud-forest species in a variety of localities have banded gasters and relatively smooth alitrunks.

BIOLOGICAL INFORMATION. *Enicospilus donahuei* is only known to occur in Central America, from about 18°N in southern Mexico south to Costa Rica. It is a relatively rarely collected species, and most specimens have been taken in cloud forests at moderately high altitudes (1200–2400 m). Despite intensive collecting it has never been taken in lowland forests.

MATERIAL EXAMINED

Holotype ♀, **Costa Rica**: Alajuela Prov., 8.2 km N. Vara Blanca, iv.1984 (*Janzen & Hallwachs*) (BMNH).

Paratypes. **Costa Rica**: Puntarenas Prov.: 1 ♂, Monteverde, 1350 m, vii.1982 (*Janzen & Hallwachs*) (BMNH); 1 ♀, same locality and collectors, 1500 m, i.1984 (MNCR); 1 ♂, same locality, vi.1985 (*Gauld*) (BMNH). Unknown Province: 1 ♀, 14 km N. Urena, vi.1974 (*Donahue*) (TC). **Guatemala**: 1 ♂, Cerro Zunil, 1700 m (*Champion*) (BMNH). **Mexico**: Chiapas: 1 ♀, San Cristobal de las Casas, 2400 m, vi.1969 (*Peterson*) (CNC); 1 ♂, Yerba Buena, 32 km N. Bochil, v.1969 (*Mason*) (CNC): Oaxaca: 1 ♀, Mpio Comaltepec, Vista Hermosa, 1450 m, ix.1962 (CNC); 1 ♀, 51 km S. Valle Nacional, 2300 m, v.1971 (*Howden & Howden*) (TC).

Enicospilus simoni sp. n.

(Figs 192, 299)

DESCRIPTION. Mandibles moderately long, very weakly narrowed, apically twisted 80–90°; upper mandibular tooth strongly compressed, 0.9–1.1 times as long as the lower tooth (Fig. 192); outer mandibular surface flat, finely punctate. Labrum 0.2–0.3 times as long as broad; malar space 0.3–0.4 times as long as basal mandibular width. Clypeus in profile weakly convex, margin fairly sharp; clypeus in front view 1.5–1.6 times as broad as long, with margin weakly convex. Lower face 0.70–0.75 times as broad as long, polished, centrally punctate. Head in dorsal view with genae rounded, sometimes slightly inflated; posterior ocellus very close to eye; FI = 65–70%; occipital carina mediodorsally weak, obsolescent or incomplete, if complete then usually dipped, ventrally curved to join hypostomal carina about 0.7–0.8 times the basal mandibular width away from mandible. Antenna long and relatively slender, with 66–70 flagellar segments; 20th segment 1.9–2.0 times as long as broad.

Mesoscutum in profile evenly rounded; notauli shallow but discernible. Mesopleuron polished, the upper part closely and finely punctate, the lower part similar but also wrinkled; epicnemial carina with upper end curved towards but not reaching anterior margin of pleuron. Scutellum in profile weakly convex, laterally carinate for 0.7 or more of its length; scutellum in dorsal view 1.5–1.6 times as long as anteriorly broad, sparsely punctate. Metapleuron convex, coarsely wrinkled-rugose; submetapleural carina evenly anteriorly broadened; posterior transverse carina of mesosternum complete. Propodeum in profile abruptly declivous; anterior transverse carina complete, posterior transverse carina vestigial or absent; anterior area short, deeply impressed, striate; spiracular area short, relatively smooth; posterior area reticulate to coarsely rugose; lateral longitudinal carina sometimes complete, usually always present anteriorly, joined to spiracular margin by a very short carina.

Fore wing length 19–26 mm; discosubmarginal cell as in Fig. 299; AI = 0.70–0.75; CI = 0.19–0.35; ICI = 0.84–1.05; SDI = 1.05–1.25; *cu-a* proximal to the base of *Rs&M*; marginal cell proximally fairly evenly hirsute, sometimes slightly more sparsely so adjacent to *Rs+2r*; 1st subdiscal cell with anterior 0.4 and distal corner hirsute. Hind wing with 7–11 hamuli on *R*1; 1st and 2nd abscissae of *Rs* more or less straight.

Fore leg with tibia quite strongly flattened, with scattered spines on outer surface. Mid leg with longer tibial spur 1.3–1.6 times length of the shorter. Hind leg with coxa in profile 1.7–1.8 times as long as deep; trochantellus dorsally 0.1–0.2 times as long as broad; 4th segment of tarsus 2.2–2.4 times as long as broad; claws of female with close, rather short pectinae, those of male similar but with pectinae closer and slightly shorter.

Gaster slender; tergite 2 in profile at least 5 times as long as posteriorly deep, laterotergite upturned, thyridia oval to obovate and separated from anterior margin of tergite by about 4–5 times its own length. Ovipositor slender, its sheath moderately narrow. Male with sternites 7–9 bearing numerous long stout erect hairs; gonosquama moderately long, usually with a weak dorsal subapical notch.

Colour generally yellowish brown, usually with dark brown mesoscutal vittae; interocellar area yellowish; antenna black, distally dark brown; pterostigma orange-brown; wings hyaline.

Variation. This is a morphologically rather uniform species over its extensive geographical range. There is some variation in the degree of pigmentation of the distal sclerite. It varies from complete, confluent with the proximal sclerite, to being virtually undiscernible. There is a little variation in the size of the central sclerite, but it is always quite small. As is usual for large species there is considerable variation in the sculpture of the posterior part of the propodeum. Specimens with coarsely rugose propodea generally have the posterior transverse carina present as a pair of lateral crests.

Remarks. This species is named after Simon Harrison, in recognition of his enthusiastic volunteer efforts in Guanacaste National Park, Costa Rica.

Enicospilus simoni is a robust, large species that can most easily be recognized by the characteristic form of the mandibles (Fig. 192); they are much stouter than the similarly strongly twisted mandibles that some other Central American species possess. *E. simoni* also has an unusually large value for ICI in the fore wing. The phylogenetic affinities of this species are not known.

Biological Information. *Enicospilus simoni* is an extremely widespread species whose range extends from Sinaloa and San Luis Potosí in Central Mexico (23–24°N) south to Paraguay (25°S). It is present on Trinidad, but does not seem to occur on the more isolated Caribbean islands (Map 27). *E. simoni* has been collected at a variety of altitudes from almost sea-level (on Barro Colorado Island) up to 2300 m in Guerrero, Mexico. In Santa Rosa National Park it has two peaks of abundance, at the begining and end of the wet season. The pooled data for 1977–1986 are:

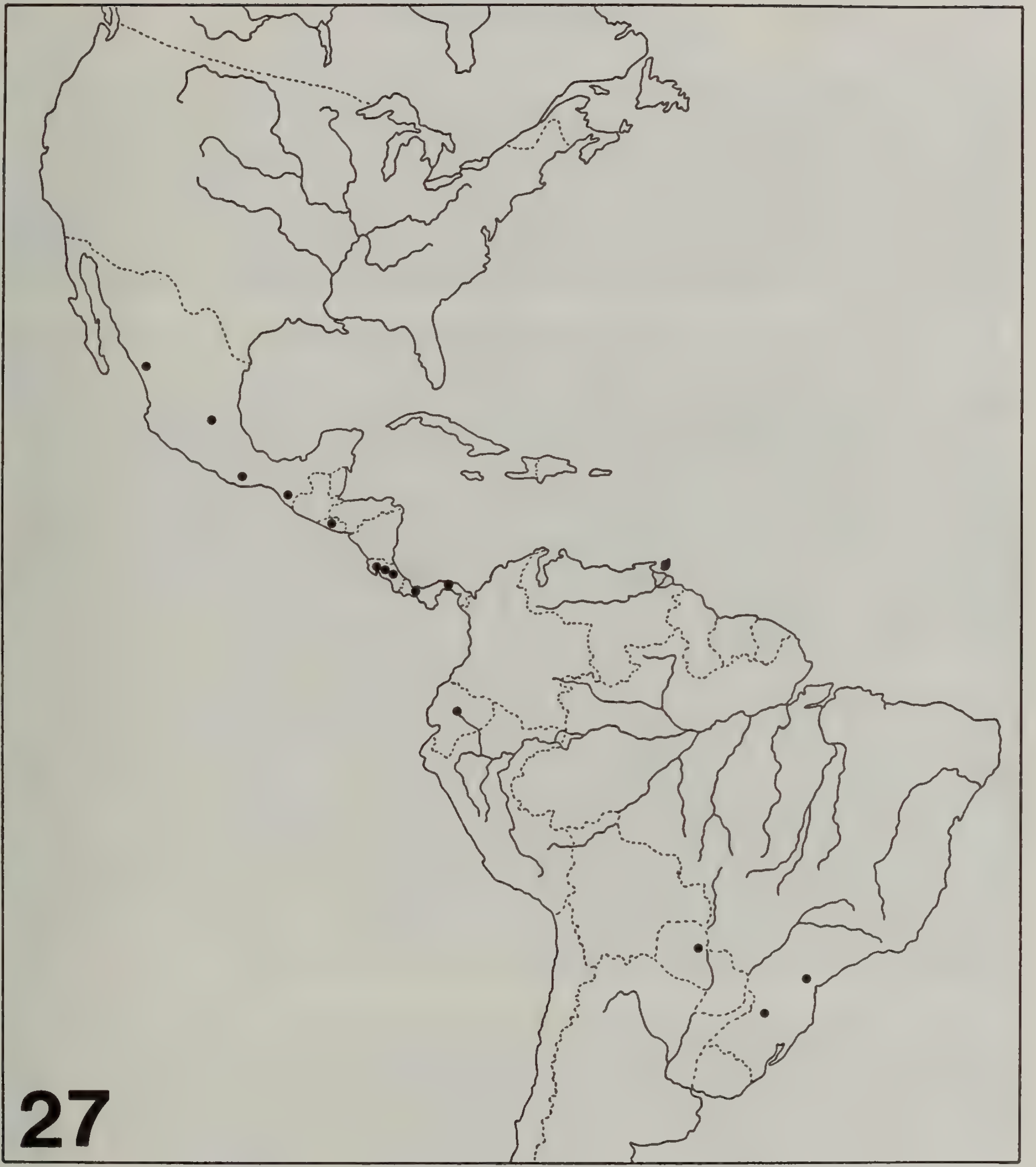
J	F	M	A	M	J	J	A	S	O	N	D
1	–	–	–	2	5	–	–	2	2	3	3

It is not known what species serve as hosts for *E. simoni*.

Material Examined

Holotype ♂, **Costa Rica**: Guanacaste Prov., Santa Rosa National Park, 300 m, xi.1982 (*Janzen & Hallwachs*) (BMNH).

Paratypes. **Brazil**: 2 ♂, Santa Catarina, Nova Teutonia, ii.1937, ii.1939 (*Plaumann*) (BMNH); 1 ♀, same locality and collector, v.1943 (TC); 1 ♂, 1 ♀, same locality and collector, viii & xii.1952 (TC); 1 ♀, same locality and collector, ix.1970 (TC); 1 ♀, São Paulo State, Casa Grande, Boraceia Field Stn, i.1975 (*Rodgers*) (TC). **Costa Rica**: Alajuela Prov.: 1 ♂, 1 ♀, San Ramón Reserve, Río San Lorencito, 800 m, v.1987 (*Chacon*) (BMNH): Cartago Prov.: 1 ♂, Turrialba, 1000 m, vii.1965 (*Real*) (CAS): Guanacaste Prov.: 1 ♂, 1 ♀, Santa Rosa National Park, 300 m, xi-xii.1977 (*Janzen*)(TC); 1 ♂, same locality and collector, xii.1979 (TC); 1 ♀, same locality xii.1980 (*Janzen & Hallwachs*) (TC); same locality and collectors, 1 ♀, vi.1981; 1 ♀, x.1982; 2 ♂, xi.1982; 1 ♂, 1 ♀, ix.1983; 1 ♂, i.1984; 1 ♀, v.1984; 1 ♀, vi.1984 (BMNH; MNCR); 2 ♀, same locality, vi.1985 (*Gauld*) (BMNH); 2 ♀, same locality and collector, v-vi.1986 (BMNH); 2 ♀, Volcán Cacao, Estacion Mengo, 1100 m, vii-ix.1987 (*Janzen*) (BMNH); 1 ♀, Volcán Orosi, Hda Mariksa [= Maritza], 550 m, i.1986 (*Hallwachs & Janzen*) (BMNH): Puntarenas Prov.: 4 ♀, Monteverde, 1350 m, xii.1961, i.1962 (*Palmer*) (TC); 1 ♀, same locality, v.1980 (*Janzen & Hallwachs*) (BMNH); 3 ♂, 7 ♀, same locality, i-iii.1986 (*Forsyth*) (CNC): San José Prov.: 2 ♀, Estacion Carrillo,



Map 27 Localities at which *Enicospilus simoni* has been collected.

Braulio Carrillo National Park, 700 m, iii & v.1985 (*Chacon*) (BMNH). **Ecuador**: 1 ♀, Abitagua, 1000 m, x.1939 (*MacIntyre*) (TC). **El Salvador**: 1 ♂, Quezaltepeque, 500 m, viii.1963 (*Cavagnaro & Irwin*) (CAS). **Mexico**: Chiapas: 7 ♀, 32 km N. Huixtla, 1000 m, vi.1969 (*Peterson*) (CNC): Guerrero: 3 ♂, 2 ♀, Xucumanatlan, 2300 m, vii.1904 (*Smith*) (BMNH): San Luis Potosí: 1 ♂, El Naranjo, 24 km W. Nuevo Morelos, x.1962 (*Townes*) (TC): Sinaloa: 1 ♀, Porterillos, 24 km W. El Palmito, 1700 m, vii.1964 (*McAlpine*) (CNC). **Panama**: 1 ♂, Barro Colorado Island, vii.1963 (*Cavagnaro & Irwin*) (CAS); same locality, 2 ♀, viii.1983; 1 ♀, xii.1983; 1 ♀, ix.1984; 1 ♀, vi.1985 (*Wolda*) (BMNH); 1 ♀, Chiriqui, Fortuna, 1050 m, iv.1978 (*Wolda*) (RNH); 3 ♀, Las Cumbres, 150 m, iv-v, 1983–85 (*Wolda*) (BMNH). **Paraguay**: 1 ♂, Sapucay, 1904 (*Foster*) (BMNH). **Trinidad**: 1 ♀, Blanchisseuse Ward, Morne Bleu, 18 km N. Simla, vi.1977 (*Grissell*) (USNM).

Enicospilus orosii sp. n.

(Figs 191, 300)

Description. Mandibles unusually short and stout, very strongly tapered, apically twisted outwards 10–15° so that upper tooth is forwards (Fig. 191); upper mandibular tooth cylindrical, 2–3 times as long as the lower tooth; outer mandibular surface rather flat, with short pubescence. Labrum 0.2–0.3 times as long as broad; malar space 0.3 times as long as basal mandibular width. Clypeus in profile quite strongly convex, margin impressed, acute; clypeus in front view 1.3–1.6 times as broad as long, margin apically truncate. Lower face 0.70–0.75 times as broad as long, polished, finely punctate. Head in dorsal view with genae slightly inflated, rounded behind eyes; posterior ocellus contiguous with eye; FI = 70–75%; occipital carina mediodorsally complete, ventrally curved to join hypostomal carina about 0.8 times the basal mandibular width away from mandible. Antenna long and slender, with 56–60 flagellar segments; 20th segment 1.7–2.3 times as long as broad.

Mesoscutum weakly polished, with obsolescent punctation, in profile evenly rounded; notauli weak but discernible. Mesopleuron polished, the upper part finely punctate, the lower part striate, wrinkled; epicnemial carina inclined towards anterior margin of pleuron, its posterior edge often crenulate. Scutellum in profile weakly convex, laterally carinate for 0.8 or more of its length; scutellum in dorsal view 1.4–1.6 times as long as anteriorly broad, punctate, posteriorly with a few longitudinal wrinkles. Metapleuron strongly convex, anteroventrally smooth, posterodorsally rugose, very strongly so in large specimens; submetapleural carina evenly anteriorly broadened; posterior transverse carina of mesosternum complete. Propodeum in profile abruptly declivous; anterior transverse carina complete, posterior transverse carina absent, or in larger specimens represented by lateral crests; anterior area rather short, deeply impressed, striate; spiracular area short, smooth; posterior area from reticulate to coarsely irregularly rugose, often with a median longitudinal ridge; lateral longitudinal carina usually complete, not joined to spiracular margin by a short carina.

Fore wing length (16) 18–24 mm; discosubmarginal cell as in Fig. 300; AI = 0.51–0.79; CI = 0.41–0.54; ICI = 0.51–0.61; SDI = 1.20–1.35; *cu-a* proximal to the base of *Rs&M*; marginal cell proximally more sparsely hirsute than it is centrally; 1st subdiscal cell with distal 0.8 almost entirely hirsute. Hind wing with 7–9 hamuli on *R*1; 1st abscissa of *Rs* weakly bowed, 2nd abscissa slightly sinuous.

Fore leg with tibia slightly flattened, with scattered spines on outer surface. Mid leg with longer tibial spur 1.4–1.5 times length of the shorter. Hind leg with coxa in profile 1.7–1.8 times as long as deep; trochantellus dorsally 0.2 times as long as broad; 4th segment of tarsus 2.1–2.4 times as long as broad; claws of female with long close pectinae, those of male similar but with pectinae shorter.

Gaster moderately slender; tergite 2 in profile at least 4 times as long as posteriorly deep, laterotergite turned under, thyridia elliptical and separated from anterior margin of tergite by about 3 or more times its own length. Ovipositor slender, its sheath moderately narrow. Male with sternites 7–9 bearing long stout erect hairs; gonosquama evenly rounded.

Colour generally yellowish brown, with tergites 3+ of gaster infuscate; mesoscutal vittae dark brown; interocellar area yellow; antenna proximally blackish, distally brownish; pterostigma brownish; wings almost hyaline.

Variation. *Enicospilus orosii* is morphologically a rather uniform species except for variation in the sculpture of the lateral part of the alitrunk and the dorsal region of the propodeum, as outlined above. Specimens from Mexico are more yellowish than yellowish brown, but they have dark markings like other specimens. The single male from Florida is virtually entirely pale yellow, with only the antennae infuscate. This specimen is also unusually small, with a fore wing length of only 16 mm. The specimen from Monteverde, which is also the largest individual, has the central sclerite about proportionately half as large as other individuals.

Remarks. *Enicospilus orosii* may easily be recognized by the form of the mandibles (Fig. 191). No other Central American species has them twisted so the upper tooth is outermost, or has them so stout and strongly tapered. The phylogenetic relationships of this species are unclear.

Biological Information. *Enicospilus orosii* is a widely distributed species whose range extends from tropical Mexico south to Guyana. I have seen a single male that was collected in Fort Myers, Florida, but apart from this there are no other records from Florida or from the Caribbean. In Costa Rica and Panama *E. orosii* is associated with wet forests from sea level up to about 1400 m. In Guanacaste Province, Costa Rica, it has been collected in the moister forest on the lower slopes of Volcán Orosi, but despite intensive collecting, it has never been taken in the nearby seasonally dry forests of Santa Rosa National Park.

E. orosii is generally very seldom collected even in sites where it does occur, and there has been relatively intensive collecting. For example, only a single specimen has been taken at Monteverde, and several years' light-trapping on Barro Colorado Island have yielded seven individuals. The majority of the Barro Colorado specimens were collected either in May or in October. Nothing is known about the biology.

MATERIAL EXAMINED

Holotype ♂, **Costa Rica**: Guanacaste Prov., Volcán Orosi, Casa Mariksa [= Maritza], 650 m, vii.1986 (*Gauld*) (BMNH).

Paratypes. **Costa Rica**: Puntarenas Prov.: 1 ♀, Monteverde, 1350 m, xi.1985 (*Haber*) (BMNH). **Guyana**: 1 ♂, Essequibo River, Morabali Ck, viii-x.1929 (BMNH). **Mexico**: Guerrero: 2 ♂, Amula, 2000 m, ix.1904 (*Smith*) (BMNH): Morelos: 1 ♀, Cuernavaca, vi.1904 (*Smith*) (BMNH). **Panama**: 1 ♀, Barro Colorado Island, x.1982 (*Wolda*) (TC); 1 ♂, same locality and collector, v.1983 (TC); same locality, 1 ♀, v.1983; 2 ♀, x.1983; 1 ♀, v.1984; vii.1985 (*Wolda*) (BMNH). **U.S.A.**: Florida: 1 ♂, Fort Myers, vi.1968 (*Heinrich*) (CNC). **Venezuela**: 1 ♀, San Esteban, nr Puerto Cabello, xii.1939 (*Anduze*) (TC).

***Enicospilus bima* sp. n.**

(Figs 193, 194, 301)

DESCRIPTION. Mandibles moderately long, proximally rather strongly narrowed, distally almost parallel-sided, apically twisted 45–60°; upper mandibular tooth slender, subcylindrical to slightly depressed, 1.6–2.0 times as long as the lower tooth; outer mandibular surface with a weak median longitudinal concavity that bears scattered hairs, and proximally is confluent with a weak basal depression. Labrum rather inflated, 0.3 times as long as broad; malar space 0.3–0.4 times as long as basal mandibular width. Clypeus in profile out-flared, with a sharp protuberant subapical margin, true margin more or less concealed; clypeus in front view 1.1–1.2 times as broad as long, with margin deeply U-shaped apically (Fig. 193). Lower face 0.70–0.76 times as broad as long, centrally punctate, often with fine striae. Head in dorsal view with genae rounded; posterior ocellus close to eye; FI = 67–73%; occipital carina mediodorsally complete, ventrally curved to approach but not actually join the hypostomal carina about 1.0 times the basal mandibular width away from mandible. Antenna slender, with 55–57 flagellar segments; 20th segment 1.8–2.0 times as long as broad.

Mesoscutum polished, with obsolescent punctures, in profile evenly rounded and with margin outturned; notauli vestigial. Mesopleuron weakly polished, the upper part finely punctate with weak striae, the lower part punctostriate to finely striate; epicnemial carina absent above lower corner of mesopleuron (Fig. 194). Scutellum in profile moderately convex, laterally carinate for virtually all of its length; scutellum in dorsal view 1.4–1.5 times as long as anteriorly broad, anteriorly punctate, posteriorly with longitudinal wrinkles. Metapleuron moderately convex, finely and rather irregularly striate to coriaceous; submetapleural carina evenly anteriorly broadened; posterior transverse carina of mesosternum broadly incomplete centrally. Propodeum in profile abruptly declivous; anterior transverse carina complete, strong, posterior transverse carina represented laterally by strong blunt prominences; anterior area short, strongly impressed, often almost smooth; spiracular area short, more or less smooth; posterior area generally weakly coriaceous or with fine irregular sculpture, and with a weak median longitudinal ridge; lateral longitudinal carina only represented by an anterior vestige, which is usually joined to spiracular margin by a short carina.

Fore wing length 14–18 mm; discosubmarginal cell as in Fig. 301; AI = 0.64–0.73; CI = 0.21–0.27; ICI = 0.88–1.17; SDI = 1.07–1.20; *cu-a* from opposite to the base of *Rs&M* to distal to it by about 0.1 times its own length; marginal cell proximally uniformly hirsute; 1st subdiscal cell with anterior and distal margins broadly hirsute. Hind wing with 6–9 hamuli on *R*1; 1st abscissa of *Rs* more or less straight, 2nd abscissa very weakly bowed.

Fore leg with tibia slightly flattened, with scattered spines on outer surface. Mid leg with longer tibial spur 1.6–1.7 times length of the shorter. Hind leg with coxa in profile 1.8–1.9 times as long as deep; trochantellus dorsally <0.1 times as long as broad; 4th segment of tarsus 2.0–2.2 times as long as broad; claws of female abruptly curved, with stout regularly spaced pectinae; those of male similar but with pectinae shorter.

Gaster moderately slender; tergite 2 in profile 2.6–3.0 times as long as posteriorly deep, laterotergite folded under, thyridia oval and separated from anterior margin of tergite by about 3 times its own length. Ovipositor rather stout, slightly decurved, its sheath moderately broad. Male with sternites 7–9 bearing numerous long, erect, slightly curved hairs; gonosquama stout, distally rounded.

Colour generally brownish yellow, with three dark longitudinal vittae on mesoscutum, and with tergites 3+ somewhat infuscate ; interocellar area yellow; antenna brownish, basally slightly darker; legs golden; pterostigma brownish; wings very slightly yellow, especially near hind margin of fore wing and along fore margin of hind wing.

VARIATION. The specimens from Barro Colorado Island are more generally yellowish than other individuals; one also has the mesoscutal vittae paler brownish.

REMARKS. This species is named in honour of Bill Eberhard and Mary-Jane West Eberhard in recognition of their great contribution to tropical biology, and as a gesture of thanks for their hospitality and help.

Enicospilus bima is immediately recognizable by the unusually protuberant clypeus and by the lack of an epicnemial carina on the lateral region of the alitrunk. The phylogenetic relationships of *E. bima* are not clear. The only other Central American species with a rather similarly modified clypeus is *E. teodorae*, but otherwise these two species have little in common, so possibly the similarly modified clypeus is an evolutionary parallelism, and not the result of common ancestry.

BIOLOGICAL INFORMATION. *Enicospilus bima* is a widespread species whose range extends from Costa Rica (11°N) south to about 22°S in Brazil. Very few specimens have been collected in South America, but it is more common in collections from Central America. In Costa Rica *E. bima* is a lowland species and has never been collected at altitudes above 700 m. Specimens have been collected in Santa Rosa National Park in some of the driest months of the year (January-February), when no hosts are available.

MATERIAL EXAMINED

Holotype ♀, **Costa Rica**: Guanacaste Prov., Santa Rosa National Park, 300 m, i.1983 (*Janzen & Hallwachs*) (BMNH).

Paratypes. **Brazil**: 1 ♀, Rio de Janeiro, Conceicaode, Macabu, i.1978 (*Alvarenga*) (TC). **Costa Rica**: Guanacaste Prov.: 1 ♂, 1 ♀, W. of Carmona, Nicoya, 6–700 m, viii.1982 (*Janzen & Hallwachs*) (BMNH); 1 ♀, Santa Rosa National Park, 300 m, xi.1982 (*Janzen & Hallwachs*) (BMNH); same locality and collectors, 1 ♀, ii.1983; 1 ♂, vii.1984 (BMNH; MNCR): Heredia Prov.: 1 ♀, Finca La Selva, Puerto Viejo de Sarapiqui, 40 m, ii.1986 (*Chavarria & Chacon*) (BMNH); 1 ♀, same locality, xi.1986 (BMNH): Limón Prov.: 5 ♀, Cerro Tortuguero, N. edge of Tortuguero National Park, 0–100 m, v.1984 (*Janzen & Hallwachs*) (BMNH): San José Prov.: 1 ♂, 1 ♀, Estacion Carrillo, Braulio Carrillo National Park, 700 m, xi.1984, v.1985 (*Chacon*) (BMNH). **Panama**: 2 ♂, Barro Colorado Island, vi.1983, v.1984 (*Wolda*) (BMNH)

Enicospilus barbarae sp. n.

(Fig. 302)

DESCRIPTION. Mandibles moderately long, proximally strongly narrowed, with a basal lobe, distally more weakly tapered, apically twisted 40–50°; upper mandibular tooth depressed, 1.3–1.6 times as long as the lower tooth; outer mandibular surface centrally almost flat, sparsely pubescent, and with a weak proximal concavity. Labrum 0.2–0.3 times as long as broad; malar space 0.3–0.4 times as long as basal mandibular width. Clypeus in profile weakly convex, margin blunt; clypeus in front view 1.3–1.4 times as broad as long, the margin weakly convex. Lower face 0.66–0.70 times as broad as long, finely punctate. Head in dorsal view with genae evenly narrowed behind eyes; posterior ocellus very close to eye; FI = 70–75%; occipital carina mediodorsally complete, ventrally curved to join hypostomal carina about 0.7–0.8 times the basal mandibular width away from mandible. Antenna slender, with 52–54 flagellar segments; 20th segment 1.9–2.1 times as long as broad.

Mesoscutum polished, with vestigial punctures, in profile abruptly rounded and with anterior margin slightly out-turned; notauli weak. Mesopleuron polished, the upper and lower parts uniformly punctate; epicnemial carina strong, curved towards anterior margin of pleuron. Scutellum in profile moderately convex, laterally carinate for 0.8 or more of its length; scutellum in dorsal view 1.4–1.5 times as long as anteriorly broad, smooth, but posteriorly with some longitudinal wrinkles. Metapleuron weakly convex, punctate, but with the punctures rather coarse and very close posterodorsally; submetapleural carina evenly anteriorly broadened; posterior transverse carina of mesosternum complete. Propodeum in profile quite long and evenly declivous; anterior transverse carina complete, posterior transverse carina absent; anterior area moderately long, with scattered striae; spiracular area quite short, smooth; posterior area with irregular wrinkling; lateral longitudinal carina more or less complete, usually joined to spiracular margin by a short carina.

Fore wing length 13–14 mm; discosubmarginal cell as in Fig. 302; AI = 1.31–1.50; CI = 0.24–0.38; ICI = 0.41–0.50; SDI = 1.29–1.52; *cu-a* proximal to the base of *Rs&M* by 0.2–0.3 times its own length; marginal cell proximally from evenly hirsute to narrowly glabrous close to *Rs+2r*; 1st subdiscal cell with anterior and distal margins hirsute. Hind wing with 6–7 hamuli on *R*1; 1st abscissa of *Rs* straight, 2nd abscissa almost straight.

Fore leg with tibia subcylindrical, with scattered slender spines on outer surface. Mid leg with longer tibial spur 1.4–1.6 times length of the shorter. Hind leg with coxa in profile 1.8–1.9 times as long as deep; trochantellus dorsally <0.1 times as long as broad; 4th segment of tarsus 2.2–2.5 times as long as broad;

claws of female rather long, distally abruptly but shortly curved, with close, short pectinae; those of male similar but with pectinae closer together.

Gaster slender; tergite 2 in profile 6–7 times as long as posteriorly deep, laterotergite turned under, thyridia elliptical and separated from anterior margin of tergite by about 2–3 times its own length. Ovipositor slender, more, or less straight, its sheath slender. Male with sternites 7–9 bearing scattered, long, erect slightly curved hairs; gonosquama distally evenly rounded.

Colour generally yellowish, with three dark brown mesoscutal vittae, and with posterior segments of gaster slightly infuscate; interocellar area yellowish, sometimes slightly infuscate close to posterior ocellus; antenna blackish, with distal apices paler; pterostigma yellowish brown; wings slightly yellowish.

VARIATION. *Enicospilus barbarae* is a morphologically and chromatically uniform species.

REMARKS. This species is named in honour of Barbara Haber for her tireless efforts on behalf of education in Monteverde.

Enicospilus barbarae is most easily recognized by the rather strongly sinuous *Rs+2r* in the fore wing (Fig. 302). No other species with black antennae and a central sclerite has this vein quite so sinuous. The form of the central sclerite – being obovate and positioned in the anterodistal margin of the fenestra – is also quite distinctive. The phylogenetic relationships of this species are not known.

BIOLOGICAL INFORMATION. *Enicospilus barbarae* has only been collected at medium elevation sites at altitudes between 1100 and 1300 m in Costa Rica and Bolivia. Nothing is known about its natural history.

MATERIAL EXAMINED

Holotype ♀, **Costa Rica**: Puntarenas Prov., Monteverde, 1350 m, no date or collector (TC).

Paratypes. **Bolivia**: 5 ♀, Chapare, Alto Palmar, 1100 m, ii.1961 (BMNH; CNC). **Costa Rica**: Puntarenas Prov.: 1 ♂, Monteverde, 1350 m, 1962 (*Palmer*) (TC).

Enicospilus fosteri sp. n.

(Fig. 303)

DESCRIPTION. Mandibles moderately long, distally evenly tapered, apically twisted 60–70°; upper mandibular tooth depressed, 1.3–1.5 times as long as the lower tooth which is slightly compressed; outer mandibular surface more or less flat, finely hirsute and with a weak proximal concavity. Labrum 0.2–0.3 times as long as broad; malar space 0.3 times as long as basal mandibular width. Clypeus in profile weakly convex, margin blunt; clypeus in front view 1.3–1.4 times as broad as long, the margin weakly convex. Lower face 0.61–0.69 times as broad as long, with fine scattered punctures. Head in dorsal view with genae evenly constricted; posterior ocellus very close to eye; FI = 70–75%; occipital carina mediodorsally complete, ventrally curved to join hypostomal carina about 0.7–0.8 times the basal mandibular width away from mandible. Antenna slender, with 57–58 flagellar segments; 20th segment 1.9 times as long as broad.

Mesoscutum polished, finely punctate, in profile steeply rounded; notauli vestigial. Mesopleuron polished, the upper and lower parts from uniformly finely and sparsely punctate, to increasingly punctostriate ventrally; epicnemial carina strong, curved towards anterior margin of pleuron. Scutellum in profile weakly convex, laterally carinate for 0.8 of its length; scutellum in dorsal view 1.5 times as long as anteriorly broad, smooth. Metapleuron moderately convex, from finely punctate with a few rugae posteriorly to diagonally striate; submetapleural carina evenly anteriorly broadened; posterior transverse carina of mesosternum complete. Propodeum in profile evenly declivous; anterior transverse carina complete, posterior transverse carina represented by lateral vestiges; anterior area short, deeply impressed, striate; spiracular area short, smooth; posterior area quite coarsely and irregularly wrinkled, with a tendency to have longitudinal wrinkles centrally; lateral longitudinal carina complete, joined to spiracular margin by a short carina.

Fore wing length 15–16 mm; discosubmarginal cell as in Fig. 303, very unusual in that the fenestra is margined anteriorly by a band of hair; AI = 0.67–0.81; CI = 0.24–0.28; ICI = 0.68–0.77; SDI = 1.21–1.30; *cu-a* proximal to base of *Rs&M* by about 0.2 times its own length; marginal cell proximally evenly hirsute or slightly more sparsely hirsute adjacent to *Rs+2r*; 1st subdiscal cell with antero-distal half hirsute. Hind wing with 5–6 hamuli on *R*1; 1st abscissa of *Rs* straight, 2nd abscissa noticeably bowed near distal end.

Fore leg with tibia subcylindrical, with scattered, slender spines on outer surface. Mid leg with longer tibial spur 1.5–1.6 times length of the shorter. Hind leg with coxa in profile 1.9 times as long as deep; trochantellus dorsally <0.1 times as long as broad; 4th segment of tarsus 1.6–1.7 times as long as broad; claws of female moderately long, abruptly curved, with short regularly spaced pectinae; claws of male similar.

Gaster slender; tergite 2 in profile about 6 times as long as posteriorly deep, laterotergite folded under, thyridia oval and separated from anterior margin of tergite by about 6 times its own length. Ovipositor straight, apically very slender, its sheath narrow. Male with sternites 7–9 bearing dense moderately stout, semierect pubescence.

Colour generally golden yellowish brown, with three dark brown vittae on the mesoscutum, and with the terminal segments of the gaster slightly infuscate; interocellar area yellow; antenna black; pterostigma brown; wings faintly yellowish.

VARIATION. The male has the lateral region of the alitrunk more striate than the two females.

REMARKS. This species is named in honour of Robin Foster in recognition of his devotion to helping all of us understand tropical tree biology.

Enicospilus fosteri is immediately recognizable because of the presence of a band of hair bordering the fenestra, immediately adjacent to *Rs+2r* (Fig. 303). No other Central American species has such a hirsute area. Structurally, and in the form of the alar sclerites, *E. fosteri* resembles *E. luisi*.

BIOLOGICAL INFORMATION. *Enicospilus fosteri* is only known to occur in Panama where it has occasionally been collected in lowland rainforest on Barro Colorado Island. No details are known of its natural history.

MATERIAL EXAMINED

Holotype ♀, **Panama**: Barro Colorado Island, 120 m, v.1985 (*Wolda*) (BMNH).

Paratypes. **Panama**: 1 ♀, Barro Colorado Island, xi.1977 (*Wolda*) (RNH); 1 ♂, same locality, vi.1978 (*Wolda*) (RNH).

***Enicospilus cornifuscus* nom. n.**

(Figs 195, 304)

Ophion (*Enicospilus*) *fuscicornis* Cameron, 1886: 291. LECTOTYPE ♀, GUATEMALA (BMNH), here designated [examined]. [Primary homonym of *Ophion fuscicornis* Erichson, 1842.]
Henicospilus fuscicornis (Cameron) Dalla Torre, 1901: 182.
Enicospilus fuscicornis (Cameron) Hooker, 1912: 60.

DESCRIPTION. Mandibles moderately long, proximally strongly tapered, distally weakly tapered, apically twisted 15–25°; upper mandibular tooth subcylindrical, 1.6–1.9 times as long as the lower tooth; outer mandibular surface centrally weakly concave, sparsely hirsute, and proximally with a weak concavity. Labrum 0.3 times as long as broad; malar space 0.3–0.4 times as long as basal mandibular width. Clypeus in profile weakly convex, margin subacute; clypeus in front view 1.3–1.5 times as broad as long, the margin almost truncate. Lower face 0.68–0.72 times as broad as long, centrally with scattered fine punctures. Head in dorsal view with genae evenly constricted behind the eyes; posterior ocellus contiguous with the eye; FI = 65–70%; occipital carina mediodorsally complete, ventrally curved to join hypostomal carina about 0.8 times the basal mandibular width away from mandible. Antenna slender, with 53–54 flagellar segments; 20th segment 1.9–2.4 times as long as broad.

Mesoscutum polished, finely punctate, in profile abruptly rounded; notauli vestigial. Mesopleuron highly polished, the upper part very finely punctate, the lower part punctate to punctostriate; epicnemial carina strong, curved towards anterior margin of pleuron, but often with upper end evanescent. Scutellum in profile weakly convex, laterally carinate for less than 0.5 of its length; scutellum in dorsal view 1.4–1.5 times as long as anteriorly broad, smooth. Metapleuron weakly convex, highly polished, finely punctate; submetapleural carina evenly anteriorly broadened; posterior transverse carina of mesosternum complete, or in some specimens weak centrally. Propodeum in profile long, weakly declivous; anterior transverse carina complete, posterior transverse carina absent; anterior area moderately short, coriaceous or with scattered striae; spiracular area long, smooth; posterior area virtually smooth and highly polished, at most with weak indistinct sculpture centrally (Fig. 195); lateral longitudinal carina from complete to completely absent, not joined to spiracular margin by a short carina.

Fore wing length 14–16 mm; discosubmarginal cell as in Fig. 304; AI = 0.78–1.24; CI = 0.17–0.30; ICI = 0.33–0.37; SDI = 0.91–1.03; *cu-a* proximal to the base of *Rs&M* by 0.1–0.2 times its own length; marginal cell proximally from slightly less densely hirsute than centrally to with a small glabrous area adjacent to *Rs+2r*; 1st subdiscal cell hirsute except at proximal end. Hind wing with 6–7 hamuli on *R*1; 1st abscissa of *Rs* slightly curved, 2nd abscissa weakly bowed.

Fore leg with tibia subcylindrical, with numerous fine spines on outer surface. Mid leg with longer tibial spur 1.5–1.7 times length of the shorter. Hind leg with coxa in profile 1.9–2.0 times as long as deep; trochantellus dorsally 0.1 times as long as broad; 4th segment of tarsus 2.3–2.5 times as long as broad; claws of female long, weakly curved, with short stout pectinae, those of male similar but with pectinae finer and closer together.

Gaster slender; tergite 2 in profile 6.0–7.0 times as long as posteriorly deep, laterotergite folded under, thyridia elliptical and separated from anterior margin of tergite by about 3–4 times its own length. Ovipositor slender, straight, its sheath narrow. Male with sternites 7–9 bearing scattered stout erect hairs; gonosquama distally subacute.

Colour generally brownish yellow, with most of head, irregular mesoscutal markings, periphery of mesoscutum, mesoscutal stripes, and scutellum brighter yellow, and with terminal segments of gaster weakly infuscate; interocellar area yellow; antenna blackish, distally slightly paler; pterostigma yellowish brown; wings hyaline.

VARIATION. The specimens from Guatemala City are slightly darker than the others. The specimen from San Lorenzo lacks longitudinal scutellar carinae, but has in their place longitudinal wrinkles.

REMARKS. Townes & Townes (1966) state that the type of *Ophion* (*Enicospilus*) *fuscicornis* Cameron is lost, but I located a syntype in the BMNH which is labelled as 'ex Cameron collection'. This I have designated as lectotype. Unfortunately it is a somewhat damaged specimen, lacking a fore and a hind wing, most of the legs and the posterior tergites of the gaster. The head has been badly glued onto the body. My supposition that this specimen is female is based on the examination of the fore tarsal claws; those of the single male I have seen have closer pectination.

Enicospilus cornifuscus is a distinctive species on account of the long and very weakly sculptured propodeum (Fig. 195). The usually small value of the SDI, the virtual absence of lateral longitudinal carinae on the scutellum and the characteristic form of the central sclerite (Fig. 304) are also important diagnostic features. *E. cornifuscus* is one of the very few Central American species with dark antennae and without black stripes on the mesoscutum.

I do not know which species *E. cornifuscus* is most closely related to. The most striking specialized features it exhibits are characters found in many tropical montane species from various regions, including New Guinea and Central Africa (Gauld & Mitchell, 1978; 1981), so I surmise these are adaptive parallelisms.

BIOLOGICAL INFORMATION. The majority of specimens I have seen were collected in southern Mexico and Guatemala, but a single female in the BMNH was collected in southern Brazil, indicating that *Enicospilus cornifuscus* extends over a considerable geographical range. The Central American specimens were all collected in sites above 1000 m. Nothing is known of the biology of this species.

MATERIAL EXAMINED

Lectotype ♀, **Guatemala**: 'S. Geronimo' (= San Jeronimo) (*Champion*) (BMNH).

Brazil: 1 ♀, Santa Catarina, Nova Teutonia, 27°11'S, 52°23'W, i.1939 (*Plaumann*) (BMNH). **Guatemala**: 4 ♀, Guatemala City (*Rodriguez*) (BMNH); 1 ♀, Zacapa, San Lorenzo, 1700 m, xi.1986 (*Sharkey*) (CNC). **Mexico**: Chiapas: 3 ♀, San Cristobal de las Casas, 2400 m, v.1969 (CNC); 4 ♀, same locality, v.1969 (*Martin*) (CNC); 1 ♂, same locality, vii.1969 (*Kritsch*) (CNC); 1 ♀, Yerba Buena, 32 km N. Bochil, v.1969 (*Mason*) (CNC).

Enicospilus catemacoi sp. n.

(Fig. 305)

DESCRIPTION. Mandibles moderately long, rather evenly narrowed, apically twisted 15°; upper mandibular tooth slender, 1.5 times as long as the lower tooth; outer mandibular surface almost flat, with scattered pubescence. Labrum 0.4 times as long as broad; malar space 0.2 times as long as basal mandibular width. Clypeus in profile almost flat, margin subacute; clypeus in front view 1.7 times as broad as long, margin truncate apically. Lower face 0.83 times as broad as long, centrally punctate. Head in dorsal view with genae slightly inflated behind eyes; posterior ocellus contiguous with eye; FI = 60%; occipital carina mediodorsally complete, ventrally curved to join hypostomal carina about 0.9 times the basal mandibular width away from mandible. Antenna slender, with 62 flagellar segments; 20th segment 1.6 times as long as broad.

Mesoscutum polished, sparsely punctate, in profile abruptly rounded, with anterior margin out-turned; notauli distinctly impressed near anterior margin. Mesopleuron polished, the upper part punctate, the lower part punctostriate; epicnemial carina curved towards anterior margin of pleuron, but with upper end evanescent. Scutellum in profile almost flat, laterally carinate for 0.8 of its length; scutellum in dorsal view 1.5 times as long as anteriorly broad, punctate, with a few longitudinal wrinkles posteriorly. Metapleuron weakly convex, anteriorly striate, posteriorly rugose-striate; submetapleural carina weakly anteriorly broadened; posterior transverse carina of mesosternum broadly incomplete centrally. Propodeum in profile abruptly declivous; anterior transverse carina complete but weak, posterior transverse carina absent; anterior area short, deeply impressed, coriaceous; spiracular area moderately long, finely punctate; posterior area coarsely irregularly wrinkled; lateral longitudinal carina absent, and therefore not joined to spiracular margin by a short carina.

Fore wing length 15 mm; discosubmarginal cell as in Fig. 305; AI = 1.00; CI = 0.39; ICI = 0.35; SDI = 1.10; *cu-a* subopposite to base of *Rs&M*; marginal cell proximally more or less evenly hirsute; 1st subdiscal cell with anterior periphery and posterodistal corner hirsute. Hind wing with 8 hamuli on *R*1; 1st abscissa of *Rs* straight, 2nd abscissa straight.

Fore leg with tibia weakly flattened, with slender scattered spines on outer surface. Mid leg with longer tibial spur 1.3 times length of the shorter. Hind leg with coxa in profile 1.9 times as long as deep; trochantellus dorsally 0.2 times as long as broad; 4th segment of tarsus 2.1 times as long as broad; claws of female abruptly curved, with close long stout pectinae.

Gaster slender; tergite 2 in profile 4.3 times as long as posteriorly deep, laterotergite folded under, thyridia elliptical and separated from anterior margin of tergite by about 4 times its own length. Ovipositor moderately slender, its sheath narrow. Male unknown.

Colour generally mottled yellowish and reddish brown, without dark mesoscutal stripes; gaster brownish, with tergites 3+ darker brown; interocellar area yellow; antenna blackish; pterostigma dark reddish brown; wings hyaline.

REMARKS. *Enicospilus catemacoi* may be recognized by the combination of black antennae, more or less completely carinate scutellum, incomplete posterior mesosternal transverse carina, small value of ICI and broad face. Structurally, especially in the form of the mandibles, it is quite similar to *E. gabrieli*, but the two may be separated, not only on the characters given in the key, but also by the form of the alar sclerites and the shape of the 2nd discal cells (compare Figs 305 and 306). The central sclerite of *E. catemacoi* is subtriangular and positioned antero-distally, and the 2nd discal cell is quite short and broad; the central sclerite of *E. gabrieli* is more ovate and positioned mediodistally, and the 2nd discal cell in long and rather narrow. These two species also differ in the sculpture of the posterior area of the propodeum; that of *E. catemacoi* is irregularly wrinkled whereas that of *E. gabrieli* is more or less concentrically rugose.

BIOLOGICAL INFORMATION. The single specimen was collected in July at a black-light run near Lake Catemaco, Veracruz, Mexico.

MATERIAL EXAMINED

Holotype ♀, **Mexico**: Veracruz, 'Coyame', Lake Catemaco, vii.1965 (*Woodruff*) (FSCA).

Enicospilus gabrieli sp. n.

(Fig. 306)

DESCRIPTION. Mandibles moderately long, rather evenly narrowed, apically twisted 20°; upper mandibular tooth subcylindrical, 1.6 times as long as the lower tooth; outer mandibular surface more or less flat, but with a weak dorsal ridge, centrally sparsely hirsute and without a distinct proximal concavity. Labrum 0.3 times as long as broad; malar space 0.3 times as long as basal mandibular width. Clypeus in profile almost flat, margin blunt; clypeus in front view 1.7 times as broad as long, the margin subtruncate apically. Lower face 0.74 times as broad as long, centrally punctate. Head in dorsal view with genae evenly narrowed behind the eyes; posterior ocellus contiguous with the eye; FI = 65%; occipital carina mediodorsally complete, ventrally curved to join hypostomal carina about 0.9 times the basal mandibular width away from mandible. Antenna slender, with apical flagellar segments missing; 20th segment 1.8 times as long as broad.

Mesoscutum polished, punctate, in profile weakly rounded; notauli distinctly impressed anteriorly. Mesopleuron polished, the upper part punctate, the lower part punctostriate; epicnemial carina curved towards anterior margin of pleuron, but with its upper end complete. Scutellum in profile almost flat, laterally carinate for 0.8 of its length; scutellum in dorsal view 1.5 times as long as anteriorly broad, punctate anteriorly, posteriorly with longitudinal wrinkles. Metapleuron moderately convex, rugose-striate; submetapleural carina evenly anteriorly broadened; posterior transverse carina of mesosternum broadly incomplete centrally. Propodeum in profile abruptly declivous; anterior transverse carina sinuous, lateromedially discontinuous, posterior transverse carina vestigial; anterior area long, shallow and striate; spiracular area short, punctate; posterior area strongly deplanate and abruptly declivous laterally, centrally rugose with the rugae tending to be concentric; lateral longitudinal carina present only as a vestige anteriorly, indistinctly joined to spiracular margin by a short carina.

Fore wing length 18 mm; discosubmarginal cell as in Fig. 306; AI = 0.79; CI = 0.44; ICI = 0.75; SDI = 1.31; *cu-a* proximal to the base of *Rs&M* by 0.1 times its own length; marginal cell proximally very slightly more sparsely hirsute than it is centrally; 1st subdiscal cell with anterior 0.5 and distal periphery hirsute. Hind wing with 8 hamuli on *R*1; 1st abscissa of *Rs* more or less straight, 2nd abscissa weakly arcuate.

Fore leg with tibia slightly flattened, with scattered, dark spines on outer surface. Mid leg with longer tibial spur 1.6 times length of the shorter. Hind leg with coxa in profile 1.7 times as long as deep; trochantellus dorsally 0.1 times as long as broad; 4th segment of tarsus 1.9 times as long as broad; claws of female abruptly curved, with close pectinae.

Gaster slender; tergite 2 in profile 4.6 times as long as posteriorly deep, laterotergite turned under, thyridia oval and separated from anterior margin of tergite by about 5 times its own length. Ovipositor slender, its sheath narrow. Male unknown.

Colour generally with head and alitrunk bright yellowish, except for mesoscutum which bears three black longitudinal stripes; legs and gaster golden; interocellar area yellow with slight infuscation between posterior ocelli; antenna black; pterostigma brown; wings virtually hyaline.

REMARKS. *Enicospilus gabrieli* may be distinguished from the other species with black antennae and an incomplete posterior transverse carina of the mesosternum (*E. catemacoi*) by the incomplete anterior transverse carina of the propodeum, the propodeal sculpture, the laterally carinate scutellum and the coloration (see also remarks under *E. catemacoi* p. 252).

BIOLOGICAL INFORMATION. The single female was collected in June at 850 m at a black-light overlooking a small area of wet forest, just on the Atlantic side of the continental divide in northern Costa Rica. It is perhaps noteworthy that only about ten nights have been spent light-trapping in this locality. *E. gabrieli* has not been collected in other Costa Rican wet forest sites (such as Monteverde and Braulio Carrillo) which have been more intensively sampled.

MATERIAL EXAMINED

Holotype ♀, **Costa Rica**: Alajuela Prov.: Finca San Gabriel, 3 km W. of Dos Ríos, 850 m, vi.1986 (*Gauld*) (BMNH)

***Enicospilus luisi* sp. n.**

(Figs 307, 308)

DESCRIPTION. Mandibles moderately long, proximally strongly narrowed and with a proximoventral lobe; mandibles distally weakly narrowed, apically twisted 45–50°; upper tooth depressed, 1.5–1.7 times as long as the lower tooth which is ventrally slightly swollen; outer mandibular surface slightly concave, with an angular ridge extending from upper corner to between teeth. Labrum 0.2–0.3 times as long as broad; malar space 0.3 times as long as basal mandibular width. Clypeus in profile weakly convex, margin inturned, slightly emarginate; clypeus in front view 1.3–1.5 times as broad as long, with margin almost truncate apically. Lower face 0.68–0.71 times as broad as long, polished, punctate, centrally sometimes slightly punctostriate. Head in dorsal view with genae evenly rounded behind eyes; posterior ocellus contiguous with eye; FI = 70–75%; occipital carina mediodorsally complete, ventrally curved to join hypostomal carina about 0.8 times the basal mandibular width away from mandible. Antenna slender, with 64–68 flagellar segments; 20th segment 2.0–2.1 times as long as broad.

Mesoscutum polished, quite closely punctate, in profile abruptly rounded; notauli vestigial. Mesopleuron polished, the upper part finely and closely punctate, the lower part with irregular transverse wrinkles; epicnemial carina inclined towards anterior margin of pleuron. Scutellum in profile moderately convex, laterally carinate for 0.8 or more of its length; scutellum in dorsal view 1.4–1.5 times as long as anteriorly broad, anteriorly smooth, posteriorly wrinkled. Metapleuron moderately convex, striate or with irregular rugae that extend dorsally onto propodeum; submetapleural carina quite strongly anteriorly broadened; posterior transverse carina of mesosternum complete, generally slightly produced centrally so entire carina is somewhat chevronate. Propodeum in profile evenly declivous; anterior transverse carina complete, posterior transverse carina vestigial, at most represented by weak lateral keels; anterior area quite long, sparsely striate; spiracular area short, smooth; posterior area rather flat, with quite coarse irregular rugae, tending towards concentrically striate laterally, centrally more reticulate; lateral longitudinal carina present only anteriorly, joined to spiracular margin by a short, sometimes discontinuous carina.

Fore wing length 18–20 mm; discosubmarginal cell as in Figs 307, 308; AI = 0.91–1.06; CI = 0.20–0.31; ICI = 0.55–0.69; SDI = 1.25–1.51; distal abscissa of 1*A* unusual in that it bears a dorsal row of long fine hairs; *cu-a* proximal to the base of *Rs&M* by 0.2–0.4 times its own length; marginal cell proximally uniformly hirsute; 1st subdiscal cell with anterior and distal parts hirsute. Hind wing with 7–8 hamuli on *R*1; 1st abscissa of *Rs* straight, 2nd abscissa weakly arcuate.

Fore leg with tibia slightly flattened, with scattered spines on outer surface. Mid leg with longer tibial spur 1.4–1.5 times length of the shorter. Hind leg with coxa in profile 1.8–1.9 times as long as deep;

trochantellus dorsally 0.1–0.2 times as long as broad; 4th segment of tarsus 2.3–2.6 times as long as broad; claws of female abruptly curved, with short stout pectinae, those of male similar but with pectinae slightly finer.

Gaster slender; tergite 2 in profile from 5.5–6.8 times as long as posteriorly deep, laterotergite turned under, thyridia obovate to elliptical and separated from anterior margin of tergite by about 4–5 times its own length. Ovipositor slender, slightly decurved, its sheath quite broad. Male with sternites 7–9 bearing long stout, erect pubescence; gonosquama distally rounded.

Colour generally pale yellowish brown, mesoscutal vittae dark brown, the gaster reddish brown to dark brownish; interocellar area yellowish, sometimes with slight infuscation between posterior ocelli; antenna proximally black, distally paler; pterostigma brown; wings weakly infumate.

VARIATION. There is slight variation in the size and shape of the alar sclerites (Figs 307, 308). The proximal one may be truncated anteriorly whilst the central one is always small, but may be circular or oval. This is otherwise a morphologically very uniform species.

REMARKS. This species is named in honour of Luis Diego Gómez, in recognition of his diverse contributions to Costa Rican biology and conservation.

Enicospilus luisi can be distinguished from all other Neotropical species by the presence of a row of long fine hairs on the dorsal surface of 1*A* in the fore wing. Structurally, particularly in the form of the mandible and in sculpture, *E. luisi* resembles *E. fosteri* and *E. opleri*.

BIOLOGICAL INFORMATION. *Enicospilus luisi* is a widely distributed species whose range extends from Chiapas in southern Mexico south to Ecuador. It has been collected in forests at altitudes from 300 to 1350 m,but is most commonly encountered at the lower elevation sites.

In Costa Rica, in Santa Rosa National Park, *E. luisi* is the most frequently collected *Enicospilus* species in Malaise traps from August until December (the latter part of the wet season). Dr D. H. Janzen has reared a single female in Santa Rosa from an unidentified species of Notodontidae found feeding on *Malpighia glabra* L. (Malpighiaceae) (rearing ref. number 84.SRNP.1456). The caterpillar was collected on 14th July and the ichneumonid emerged on the 5th August.

MATERIAL EXAMINED

Holotype ♀, **Costa Rica**: Guanacaste Prov., Santa Rosa National Park, 300 m, viii.1984 (*Janzen & Hallwachs*) (BMNH).

Paratypes. **Costa Rica**: Guanacaste Prov.: 1 ♀, 4 km E. Casetilla, Rincón de la Vieja National Park, 750 m, xii.1981 (*Janzen & Hallwachs*) (BMNH); 1 ♂, Santa Rosa National Park, 300 m, vii.1982 (*Janzen & Hallwachs*) (BMNH); same locality and collectors, 1 ♀, vi.1984; 6 ♀, viii.1984; 8 ♀, viii-xii.1984 (BMNH): Puntarenas Prov.: 1 ♂, Monteverde, 1350 m, ii.1986 (*Haber*) (BMNH); 1 ♀, same locality, i.1986 (*Forsyth*) (CNC). **Ecuador**: 1 ♀, Zamora, iv.1965 (*Peña*) (TC). **Mexico**: Chiapas: 2 ♀, 32 km N. Huixtla, 1000 m, vi.1969 (CNC). **Panama**: 1 ♂, Chiriqui, Fortuna, 1050 m, i.1978 (*Wolda*) (RNH). **Venezuela**: 2 ♀, Tucuco, Zulia, iv.1981 (*Townes*) (TC).

Enicospilus opleri sp. n.

DESCRIPTION. Mandibles moderately long, distally fairly evenly narrowed, apically twisted 40–50°; upper mandibular tooth depressed, slender, 1.3–1.5 times as long as the lower tooth which is swollen and rather convex ventrally; outer mandibular surface with a weak longitudinal concavity that is margined dorsally by a small ridge that extends from base of upper tooth to upper corner of mandibular base, this depression sparsely pubescent; proximal concavity weak. Labrum 0.2–0.3 times as long as broad; malar space 0.2–0.3 times as long as basal mandibular width. Clypeus in profile weakly convex, margin blunt to subacute; clypeus in front view 1.3–1.5 times as broad as long, with margin apically truncate. Lower face 0.65–0.69 times as broad as long, centrally finely punctate, sometimes virtually smooth. Head in dorsal view with genae evenly rounded behind eyes; posterior ocellus contiguous with eye; FI = 75–80%; occipital carina mediodorsally complete, ventrally curved to join hypostomal carina about 0.7–0.9 times the basal mandibular width away from mandible. Antenna slender, with 62–65 flagellar segments; 20th segment 1.7–1.8 times as long as broad.

Mesoscutum polished, finely punctate, in profile rather abruptly rounded, with anterior margin outturned; notauli weak but discernible anteriorly. Mesopleuron highly polished, the upper part regularly punctate, the lower part often similar to the upper but generally with some tendency to punctostriation; epicnemial carina curved towards but not joining anterior margin of pleuron. Scutellum in profile moderately convex, laterally carinate for 0.7 or more of its length; scutellum in dorsal view 1.4–1.5 times as long as anteriorly broad, anteriorly smooth or punctate, posteriorly generally with longitudinal wrinkling.

Metapleuron weakly convex, with strong rugae posterodorsally; submetapleural carina evenly anteriorly broadened; posterior transverse carina of mesosternum complete. Propodeum in profile abruptly declivous; anterior transverse carina complete, posterior transverse carina vestigial, at most represented by lateral crests; anterior area quite long, deep, striate; spiracular area rather short, smooth; posterior area coarsely reticulate-rugose, often with rugae tending to be longitudinal anterocentrally, and sometimes even subconcentric posteriorly; lateral longitudinal carina present anterior to anterior transverse carina, to which it is often joined, and joined to spiracular margin by a short carina.

Fore wing length 16–20 mm; discosubmarginal cell very like those shown in Figs 307, 308, except that vein 1*A* does not bear long hairs; AI = 0.70–0.81; CI = 0.25–0.30; ICI = 0.59–0.88; SDI = 1.31–1.49; *cu-a* proximal to the base of *Rs&M* by 0.1–0.3 times its own length; marginal cell proximally fairly uniformly hirsute; 1st subdiscal cell extensively hirsute except for posteroproximal corner. Hind wing with 7–8 hamuli on *R*1; 1st abscissa of *Rs* straight, 2nd abscissa weakly bowed.

Fore leg with tibia distinctly flattened, with numerous scattered spines on outer surface. Mid leg with longer tibial spur 1.3–1.6 times length of the shorter. Hind leg with coxa in profile 1.8–1.9 times as long as deep; trochantellus dorsally 0.1 times as long as broad; 4th segment of tarsus 2.0–2.2 times as long as broad; claws of female abruptly curved, with long stout pectinae; those of male similar but with pectinae closer and shorter.

Gaster slender; tergite 2 in profile 5.2–5.8 times as long as posteriorly deep, laterotergite turned under, thyridia oval and separated from anterior margin of tergite by about 4–5 times its own length. Ovipositor slender, its sheath narrow. Male with sternites 7–9 bearing numerous long stout erect, slightly curved hairs; gonosquama distally evenly rounded.

Colour generally yellowish to reddish brown, usually with tergites 3+ of gaster somewhat infuscate, always with three black longitudinal vittae on the mesoscutum; interocellar area yellowish, sometimes indistinctly blackish posteriorly, adjacent to ocelli; antenna black; pterostigma brown; wings weakly infumate.

VARIATION. The specimens from Florida are generally more orange-yellow than others, but structurally they are otherwise typical examples of the species.

REMARKS. This species is named in honour of Paul Opler in recognition of his many efforts on behalf of insect conservation.

The most distinctive feature of *Enicospilus opleri* is the presence of a group of hairs in the extreme anterior corner of the discosubmarginal cell, adjacent to the base of *Rs+2r* (cf. Fig. 307). This feature in combination with the characteristic alar sclerites, slightly ridged mandibles and black antenna serve to distinguish *E. opleri* from all other species except *E. luisi*. In many other features, such as the form of the mandibles, general sculpture, alar indices, and position of the alar sclerites, *E. opleri* and *E. luisi* are very similar, but *E. opleri* does not have slender hairs on the upper surface of the distal abscissa of 1*A*.

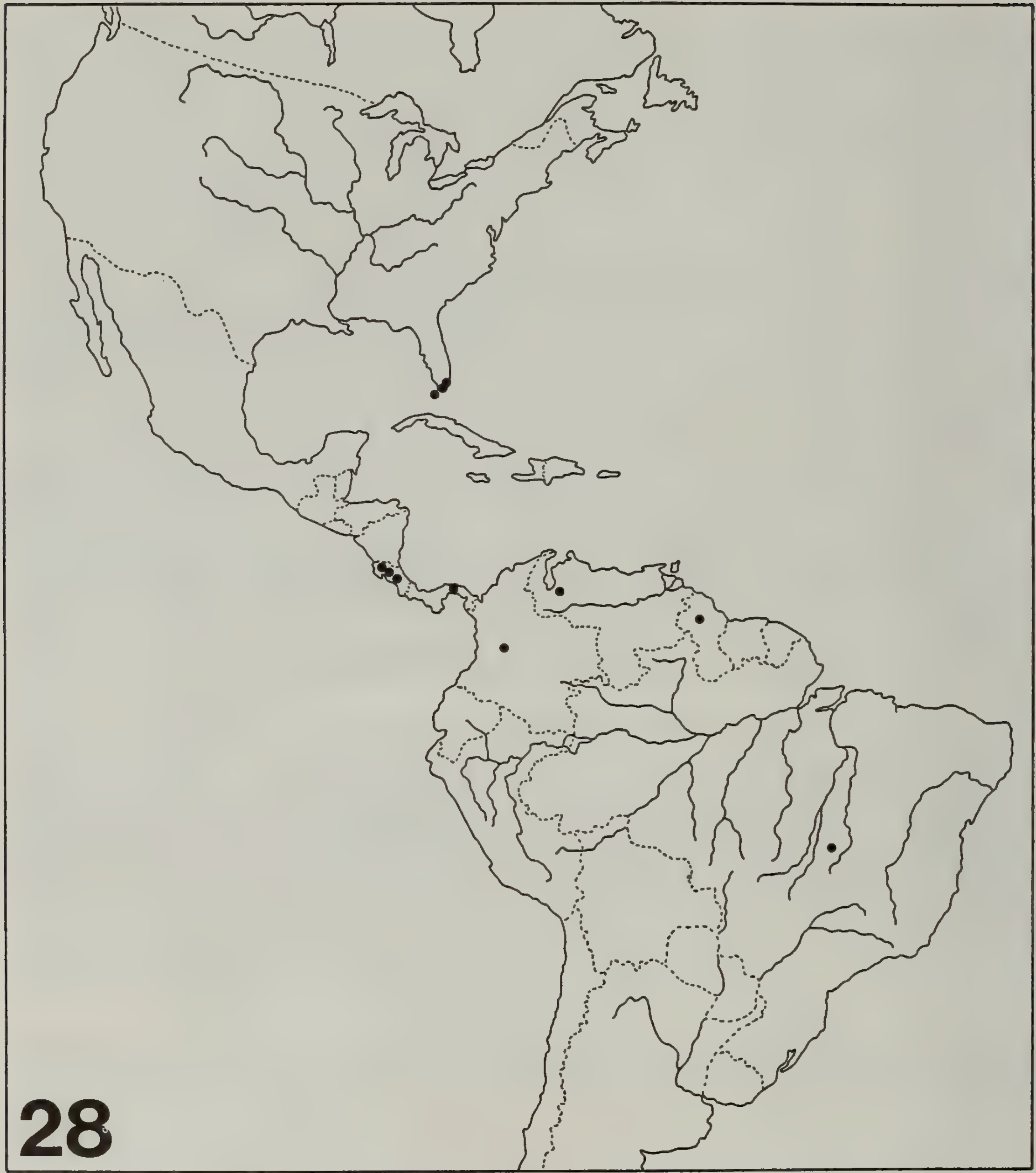
BIOLOGICAL INFORMATION. *Enicospilus opleri* is a widespread species (Map 28) whose range extends from northern Costa Rica (11°N) south to Bahia, Central Brazil (*ca* 10°S). Several individuals have also been collected in the extreme southern tip of Florida and on the Florida Keys, though I have seen no other material from the Caribbean.

In Central America *E. opleri* has been collected from almost sea level up to about 1800 m. In Santa Rosa National Park, Costa Rica, despite intensive sampling, only a single specimen has been collected, in June, at the start of the wet season. Nothing is known of the natural history of this species.

MATERIAL EXAMINED

Holotype ♀, **Costa Rica**: Cartago Prov., 3 km S. Casa Mata, 21.6 km S. San Isidro de Tejar, 1800 m, xii.1983 (*Janzen & Hallwachs*) (BMNH).

Paratypes. **Brazil**: 1 ♀, Bahia, Encruzilhada, 900 m, xi.1972 (*Alvarenga*) (TC). **Colombia**: 1 ♂, Monterredondo, Cundinamarca, xii.1956 (*Foerster*) (TC). **Costa Rica**: Cartago Prov.: 1 ♀, 3 km S. Casa Mata, 21.6 km S. San Isidro de Tejar, 1800 m, xii.1983 (*Janzen & Hallwachs*) (BMNH): Guanacaste Prov.: 1 ♀, Santa Rosa National Park, 300 m, vi.1984 (*Janzen & Hallwachs*) (BMNH): Heredia Prov.: 1 ♂, Puerto Viejo de Sarapiqui, Finca la Selva, iv.1986 (BMNH): Puntarenas Prov.: 1 ♂, 1 ♀, Finca Las Cruces, 6 km S. San Vito de Java, 1400 m, ix.1986 (*Eger*) (BMNH). **Guyana**: 1 ♀, Kuraubam Ck, Cattle trail survey, ix.1919 (*Abraham*) (BMNH). **Panama**: 3 ♀, Barro Colorado Island, xi.1983 & vi.1985 (*Wolda*) (BMNH). **U.S.A.**: Florida: 1 ♀, Dade Co., Fuch's Hammock, nr Homestead, v.1979 (*Dickel & Weems*) (FSCA); 1 ♀, Monroe Co., Big Pine Key, Alligator Ford, vii.1978 (*Stange*) (FSCA); 2 ♀, Monroe Co., Key Largo Key, 16 km N. Key Largo City, i.1974 (*Heppner*) (FSCA); 1 ♀, Monroe Co., No Name Key, xii.1972 (*Dodge*) (FSCA). **Venezuela**: 1 ♀, Tucuco, Zulia, iv.1981 (*Townes*) (TC).



Map 28 Localities at which *Enicospilus opleri* has been collected.

Enicospilus guindoni sp. n.

(Figs 132, 309)

Description. Mandibles moderately long, proximally abruptly narrowed, so a distinct ventral lobe is discernible, distally slender and weakly narrowed, apically twisted about 40°; upper mandibular tooth slender, depressed, 1.4–1.6 times as long as the lower tooth; outer mandibular surface almost flat, with scattered pubescence, proximally with a weak concavity. Labrum 0.2 times as long as broad; malar space 0.2–0.3 times as long as basal mandibular width. Clypeus in profile very weakly convex, margin blunt; clypeus in front view 1.3–1.5 times as broad as long, the margin truncate apically. Lower face 0.70–0.73

times as broad as long, centrally finely, sparsely punctate. Head in dorsal view with genae evenly rounded behind eyes; posterior ocellus very close to eye; FI = 70–75; occipital carina mediodorsally complete, ventrally curved to join hypostomal carina about 0.7–0.8 times the basal mandibular width away from mandible. Antenna slender, with 56–58 flagellar segments; 20th segment 2.0–2.2 times as long as broad.

Mesoscutum polished, very finely punctate, in profile evenly rounded; notauli vestigial. Mesopleuron polished, the upper part finely punctate, the lower part similar but with some striation present; epicnemial carina inclined towards anterior margin of pleuron. Scutellum in profile almost flat, laterally carinate for 0.3 or less of its length; scutellum in dorsal view 1.5 times as long as anteriorly broad, rather smooth with scattered punctures, without wrinkling posteriorly. Metapleuron moderately convex, generally punctate, sometimes with some rugae posterodorsally; submetapleural carina weakly broadened anteriorly; posterior transverse carina of mesosternum complete, projecting forward on midline so that in ventral view the carina appears to form a chevron (Fig. 132). Propodeum in profile fairly evenly declivous; anterior transverse carina strong and complete, posterior transverse carina represented laterally by crests; anterior area long and shallow, striate; spiracular area rather short, smooth; posterior area irregularly wrinkled-rugose, with a median longitudinal wrinkle present anteriorly, the other rugae often tending to be subconcentric, but generally with these usually weakly developed; lateral longitudinal carina from complete to interrupted centrally, joined to spiracular margin by a short carina.

Fore wing length 18–19 mm; discosubmarginal cell as in Fig. 309; AI = 1.03–1.32; CI = 0.21–0.36; ICI = 0.51–0.60; SDI = 1.27–1.39; *cu-a* proximal to the base of *Rs&M* by about 0.2 times its own length; marginal cell proximally more sparsely hirsute than it is centrally; 1st subdiscal cell with anterodistal part hirsute. Hind wing with 7–8 hamuli on *R*1; 1st abscissa of *Rs* almost straight, 2nd abscissa straight.

Fore leg with tibia weakly flattened, with scattered slender spines on outer surface. Mid leg with longer tibial spur 1.4–1.5 times length of the shorter. Hind leg with coxa in profile 1.7–1.8 times as long as deep; trochantellus dorsally 0.1 times as long as broad; 4th segment of tarsus 1.6–2.0 times as long as broad; claws of female quite long, distally abruptly rounded, with rather short, close pectinae.

Gaster very slender; tergite 2 in profile 7–8 times as long as posteriorly deep, laterotergite folded under, thyridia elliptical and separated from anterior margin of tergite by about 4 times its own length. Ovipositor quite slender, slightly decurved, its sheath narrow. Male unknown.

Colour generally yellowish, with three longitudinal dark brown stripes on mesoscutum; gaster with tergites 3+ laterally rather pale, dorsally and ventrally very slightly infuscate; interocellar area yellow, or slightly infuscate close to posterior ocelli; antenna black; pterostigma yellowish brown; wings weakly infumate.

VARIATION. The Costa Rican and Bolivian specimens are remarkably alike, except that the mandibles of the former are very slightly more slender than are those of Bolivian examples.

REMARKS. This species is named in honour of Wolf Guindon, in recognition for his devotion to conservation in the Monteverde area, and for his help in the field.

Enicospilus guindoni may be recognized by the following combination of features: the centrally produced, chevronate posterior transverse carina of the mesosternum; the black antennae; the short lateral carinae of the scutellum; the weak rugae on the propodeal posterior area; and the small, perpendicular central sclerite. No other Central American species shares all these features.

The form of the alar sclerites is similar to that found in *E. leoni* (cf. Figs 309 and 311) and possibly the two species are closely related.

BIOLOGICAL INFORMATION. *Enicospilus guindoni* is only known from two sites at mid altitude (1100–1300 m) in Costa Rica and Bolivia, but presumably it occurs at similar elevations along the Andes in intervening countries. At Monteverde the two females were collected at a black light in cloud forest. Although other workers have collected many specimens in Monteverde adjacent to the forest (between 1984 and 1986), they have not taken any further examples of this species. Possibly *E. guindoni* is restricted just to the forest.

MATERIAL EXAMINED

Holotype ♀, **Costa Rica**: Puntarenas Prov., Monteverde, 1300 m, iv-v.1984 (*Gauld*) (BMNH).

Paratypes. **Bolivia**: 2 ♀, Chapare, Alto Palmar, 1100 m, ii.1961 (CNC). **Costa Rica**: Puntarenas Prov.: 1 ♀, Monteverde, 1300 m, iv-v.1984 (*Gauld*) (BMNH).

Enicospilus leoni sp. n.

(Figs 133, 196, 197, 311)

DESCRIPTION. Mandibles moderately long, evenly tapered, but with a very small basal lobe, apically twisted 20°; upper mandibular tooth slender, depressed, 1.3–1.5 times as long as the lower tooth (Fig. 196); outer mandibular surface centrally weakly concave, with a weak ridge extending from base of upper tooth to mandibular base, the concave area bearing close pubescence. Labrum 0.2–0.3 times as long as broad; malar space 0.2 times as long as basal mandibular width. Clypeus in profile very weakly convex, margin blunt; clypeus in front view 1.3–1.4 times as broad as long, with margin weakly convex apically. Lower face 0.70–0.74 times as broad as long, polished, centrally sparsely punctate. Head in dorsal view with genae strongly constricted behind eyes; posterior ocellus contiguous with eye; FI = 70–75%; occipital carina mediodorsally complete, ventrally curved to join hypostomal carina about 0.8 times the basal mandibular width away from mandible. Antenna long and slender, with 53–56 flagellar segments; 20th segment 2.2–2.4 times as long as broad.

Mesoscutum polished, with fine punctures, in profile abruptly rounded; notauli absent. Mesopleuron polished, the upper part finely punctate, the lower part punctate to punctostriate; epicnemial carina inclined towards anterior, but not reaching margin of pleuron. Scutellum in profile weakly convex, laterally carinate for most of its length; scutellum in dorsal view 1.6–1.7 times as long as anteriorly broad, anteriorly smooth, posterior weakly wrinkled. Metapleuron weakly convex, more or less striate (Fig. 197); submetapleural carina weakly anteriorly broadened; posterior transverse carina of mesosternum complete. Propodeum in profile evenly rounded; anterior transverse carina complete, posterior transverse carina absent; anterior area short, and deep, striate to coriaceous; spiracular area quite long, smooth; posterior area irregularly reticulate; lateral longitudinal carina from present only as a small vestige anteriorly, to incomplete posteriorly anteriorly joined to spiracular margin by a short carina.

Fore wing length 12–14 mm; discosubmarginal cell as in Fig. 311; AI = 1.00–1.50; CI = 0.23–0.30; ICI = 0.40–0.45; SDI = 1.00–1.17; *cu-a* from subopposite to proximal to the base of *Rs&M* by 0.1 times its own length; marginal cell proximally narrowly glabrous; 1st subdiscal cell with anterior 0.3 sparsely hirsute. Hind wing with 5–7 hamuli on *R*1; 1st abscissa of *Rs* straight, 2nd abscissa almost straight or weakly bowed.

Fore leg with tibia slightly flattened, with scattered spines on outer surface. Mid leg with longer tibial spur 1.5–1.7 times length of the shorter. Hind leg with coxa in profile 1.8–1.9 times as long as deep; trochantellus dorsally 0.1 times as long as broad; 4th segment of tarsus 2.0–2.4 times as long as broad; claws of female with close, long pectinae, those of male with pectinae very short and closely interspaced.

Gaster slender; tergite 2 in profile 5 or more times as long as posteriorly deep, laterotergite folded under, thyridia obovate and separated from anterior margin of tergite by about 5–6 times its own length. Ovipositor slender, very slightly decurved, its sheath moderately narrow. Males with sternites 7–9 bearing numerous rather fine, erect hairs; gonosquama with a weak dorsal notch, distally rounded.

Colour generally brownish yellow with dark brown mesoscutal vittae and with tergites 3+ of gaster infuscate; interocellar area yellow; antenna proximally black, distally yellowish brown; pterostigma orange; wings hyaline.

VARIATION. The majority of specimens have the distal sclerite very weakly sclerotized and confluent with the proximal sclerite. Several individuals have the medial part of the distal sclerite thickened.

REMARKS. This species is named in honour of Pedro León in recognition of his efforts to improve the quality of Costa Rican high school biology texts.

Enicospilus leoni can most easily be recognized by the I-shaped central sclerite, a feature it shares with *E. guindoni* and *E. monticola*. These three species can easily be separated by the characters given in the key.

BIOLOGICAL INFORMATION. *Enicospilus leoni* is a widespread species whose range extends from northern Costa Rica south to Bolivia and central Brazil. The majority of specimens have been collected below 1000 m, although one Bolivian individual is purported to have been collected at 2200 m.

In Central America *E. leoni* has only been collected infrequently. Despite a considerable collecting effort in Costa Rica only three specimens have been taken, and all these are from Santa Rosa National Park, possibly the northern extremity of the species' range. Nothing is known about the biology of this insect.

MATERIAL EXAMINED

Holotype ♀, **Panama**: Barro Colorado Island, 120 m, vi.1984 (*Wolda*) (BMNH).

Paratypes. **Bolivia**: 1 ♀, Chapare Prov., El Limbo, 2200 m, i.1962 (CNC); 1 ♀, La Paz, Yungas, 1600 m, xii.1984 (*Peña*) (TC). **Brazil**: 9 ♀, Bahia, Encruzilhada, 960 m, xi.1972 (*Alvarenga*) (TC); 1 ♀, Minas Gerais, Aguas Vermelhas, 800 m, xii.1983 (*Alvarenga*) (TC); 3 ♀, Minas Gerais, Pedras Azul, 800 m, xi.1972 (*Alvarenga & Seabra*) (TC). **Colombia**: 1 ♀, Magdalena, 11°10'N 74°8'W, 800 m, iv.1973 (*Helava*) (BMNH). **Costa Rica**: Guanacaste Prov.: 1 ♀, Santa Rosa National Park, 300 m, viii.1982 (*Janzen & Hallwachs*) (BMNH); 1 ♂, 1 ♀, same locality and collectors, v-vi.1983 (BMNH). **Panama**: 1 ♂, Barro Colorado Island, vii.1983 (*Wolda*) (BMNH); same locality, 1 ♂, ix.1983, 1 ♂, v.1984, 1 ♂, vi.1985

(*Wolda*) (BMNH). **Venezuela**: 1 ♀, Aragua, Rancho Grande, v.1960 (*Test*) (UMC); 1 ♀, San Esteban, nr Puerto Cabello, xii.1939 (*Anduze*) (TC).

Enicospilus kelloggae sp. n.

(Figs 198, 199, 312)

DESCRIPTION. Mandibles of moderate length, proximally abruptly narrowed, distally weakly narrowed, apically twisted 40–60°; upper mandibular tooth rather slender, 1.3–1.5 times as long as the lower tooth which is swollen and has a sharp, convex ventral margin (Fig. 199); outer mandibular surface almost flat, sparsely hirsute. Labrum 0.2–0.3 times as long as broad; malar space 0.3–0.4 times as long as basal mandibular width. Clypeus in profile weakly convex, almost flat, margin blunt; clypeus in front view 1.3–1.5 times as broad as long, the margin apically subtruncate. Lower face 0.65–0.73 times as broad as long, centrally punctate. Head in dorsal view with genae narrowed behind eyes; posterior ocellus contiguous with eye; FI = 70–75%; occipital carina mediodorsally complete, ventrally curved to join hypostomal carina about 0.7–0.8 times the basal mandibular width away from mandible. Antenna slender, with 54–60 flagellar segments; 20th segment 2.0–2.4 times as long as broad.

Mesoscutum polished, finely punctate, in profile abruptly rounded with anterior margin out-turned; notauli weak but distinctly impressed anteriorly. Mesopleuron polished, the upper part finely punctate, the lower part from punctate to punctostriate; epicnemial carina curved towards anterior margin of pleuron. Scutellum in profile moderately convex, laterally carinate for less than 0.6 of its length (Fig. 198); scutellum in dorsal view 1.4–1.5 times as long as anteriorly broad, generally uniformly smooth. Metapleuron weakly to moderately convex, polished, rather uniformly finely and sparsely punctate; submetapleural carina evenly anteriorly broadened; posterior transverse carina of mesosternum usually complete. Propodeum in profile evenly declivous; anterior transverse carina from complete to interrupted lateromedially, posterior transverse carina absent, or more usually vestigial and discernible as an oblique ridge laterally; anterior area quite long, striate; spiracular area short to moderately long, smooth or finely punctate; posterior area with weak rugosities, anterolaterally almost coriaceous, centrally with one or more weak to distinct longitudinal wrinkles; lateral longitudinal carina from complete to present only anteriorly, joined to spiracular margin by a short carina.

Fore wing length 15–18 mm; discosubmarginal cell as in Fig. 312; AI = 0.85–1.00; CI = 0.29–0.44; ICI = 0.50–0.79; SDI = 1.11–1.29; *cu-a* proximal to the base of *Rs&M* by 0.2–0.4 times its own length; marginal cell proximally from uniformly hirsute to with a narrow glabrous area adjacent to *Rs+2r*; 1st subdiscal cell with anterior and distal parts broadly hirsute, often with only a narrow glabrous area posteriorly. Hind wing with 6–7 hamuli on *R*1; 1st abscissa of *Rs* straight, 2nd abscissa weakly bowed.

Fore leg with tibia slightly flattened, with scattered spines on outer surface. Mid leg with longer tibial spur 1.3–1.6 times length of the shorter. Hind leg with coxa in profile 1.7–1.9 times as long as deep; trochantellus dorsally 0.1 times as long as broad; 4th segment of tarsus 1.9–2.5 times as long as broad; claws of female moderately long, abruptly curved, with close pectinae; claws of male similar but with pectinae slightly shorter and closer together.

Gaster slender; tergite 2 in profile 4.6–6.0 times as long as posteriorly deep, laterotergite folded under, thyridia oval to oval/elliptical and separated from anterior margin of tergite by about 4–5 times its own length. Ovipositor quite stout, strongly tapered, its sheath slender. Male with sternites 7–9 bearing long stout erect pubescence; gonosquama distally rounded.

Colour generally orange-brown, with most of head and scutellum paler yellowish and with mesoscutal vittae blackish; interocellar area yellowish, generally blackish between posterior ocelli, often with blackish marks on the frons between the median ocellus and the antennal socket; antenna black; pterostigma brownish; wings weakly infumate.

VARIATION. The specimens from San Ramón, Monteverde and Fortuna have tergites 3+ of the gaster distinctly infuscate. The specimen from Venezuela is generally paler yellowish brown, and does not have the interocellar area dark. Occasional individuals have the sculpture on the posterior area of the propodeum very weak. One specimen from Braulio Carrillo only has anterior vestiges of the scutellar carina discernible, and has the posterior transverse carina of the mesosternum incomplete centrally.

There seem to be two forms of central sclerite. Most individuals have a subcircular, quite large and weakly sclerotized central sclerite whereas a number of other individuals have this sclerite smaller, more strongly sclerotized and somewhat comma-shaped.

REMARKS. This species is named in honour of Liz Kellogg for her untiring efforts on behalf of Guanacaste National Park, Costa Rica, and in gratitude for her assistance in staying mobile.

Enicospilus kelloggae is not a particularly easy species to recognize. Its most distinctive feature is the swollen lower tooth of the mandible, but this requires practice to appreciate. It may be separated from other species by the combination of short scutellar carinae and by the more or less complete distal sclerite. Structurally it is quite similar to *E. lacsa*; both species are similarly sculptured, particularly on the metapleuron, but *E. lacsa* has more slender antennae and lacks a distinct distal sclerite.

E. kelloggae has a rather similar shaped mandible to *E. luisi*. *E. luisi* may most easily be distinguished from *E. kelloggae* by the long hairs present on vein *1A* in the fore wing; such hairs are not present on the wings of *E. kelloggae*.

BIOLOGICAL INFORMATION. *Enicospilus kelloggae* is a fairly widely distributed species whose range extends from near Huixtla, about 15°N in southern Mexico, south to Venezuela. It has most frequently been collected in humid forests at altitudes between 700 and 1350 m. Nothing is known of the biology of this species.

MATERIAL EXAMINED

Holotype ♀, **Costa Rica**: Alajuela Prov., Virgen de Socorro, 800 m, ii.1987 (*Janzen & Hallwachs*) (BMNH).

Paratypes. **Costa Rica**: Alajuela Prov.: 1 ♂, Finca Campana, 5 km NW. Dos Ríos, 750 m, iii.1985 (*Janzen & Hallwachs*) (BMNH); 1 ♀, Finca San Gabriel, 3 km W. Dos Ríos, 850 m, vi.1986 (*Gauld*) (BMNH); 1 ♂, 1 ♀, San Ramón Reserve, Río San Lorencito, 800 m, ii.1987 (*Chacon*) (BMNH); 1 ♂, same locality, v.1987 (*Chacon*) (BMNH); 2 ♂, San Vito, Las Cruces, xi.1987 (*Chacon*) (BMNH); 1 ♀, Virgen de Socorro, 800 m, ii.1987 (*Janzen & Hallwachs*) (BMNH): Cartago Prov.: 1 ♀, Turrialba, 700 m, vii.1965 (*Real*) (CAS): Guanacaste Prov.: 1 ♂, Estacion Mengo on SW. side of Volcán Cacao, 1100 m, v.1987 (*Janzen*) (BMNH): Puntarenas Prov.: 1 ♀, Monteverde, 1350 m, xii.1985 (*Haber*) (BMNH): San José Prov.: 2 ♀, Estacion Carrillo, Braulio Carrillo National Park, 700 m, x. 1984 & v.1985 (*Chacon*) (BMNH). Mexico: Chiapas: 1 ♀, 32 km N. Huixtla, 1000 m, vi.1969 (*Mason*) (CNC). **Panama**: 1 ♀, Barro Colorado Island, 120 m, x.1984 (*Wolda*) (BMNH); 2 ♀, Chiriqui, Fortuna, 1050 m, iv & x.1978 (*Wolda*) (RNH). **Venezuela**: 1 ♀, El Junquito, D.F., i.1939 (*Berthier*) (TC).

Enicospilus mengoi sp. n.

(Fig. 314)

DESCRIPTION. Mandibles rather short, distally fairly evenly tapered, apically twisted 20–30°; upper mandibular tooth slender, 1.3 times as long as the lower tooth; outer mandibular surface centrally almost flat, proximally with a weak concavity, and sparsely pubescent. Labrum 0.2 times as long as broad; malar space 0.2 times as long as basal mandibular width. Clypeus in profile moderately convex, margin blunt; clypeus in front view 1.3–1.4 times as broad as long, the margin weakly convex apically. Lower face 0.61–0.70 times as broad as long, rather flat, centrally sparsely punctate. Head in dorsal view with genae constricted behind eyes; posterior ocellus contiguous with eye; FI = 80%; occipital carina mediodorsally complete, flattened slightly, ventrally curved to join hypostomal carina about 0.8 times the basal mandibular width away from mandible. Antenna slender, with 52–54 flagellar segments; 20th segment 2.3–2.4 times as long as broad; distal flagellar segments apparently with shorter sensilla than is usually encountered in species of this genus.

Mesoscutum polished, with vestigial punctures, in profile evenly rounded but with anterior margin outturned; notauli weak. Mesopleuron polished, the upper part finely punctate, with a few irregular striae, the lower part with numerous wrinkle-like striae present; epicnemial carina strong, curved towards anterior margin of pleuron, but with upper end evanescent. Scutellum in profile weakly rounded, laterally carinate for most of its length; scutellum in dorsal view 1.6 times as long as anteriorly broad, rather smooth. Metapleuron weakly convex, smooth with very fine punctures; submetapleural carina fairly evenly anteriorly broadened; posterior transverse carina of mesosternum complete. Propodeum in profile evenly declivous; anterior transverse carina complete, posterior transverse carina absent; anterior area quite long, striate; spiracular area long, smooth; posterior area with weak irregular wrinkling, with a moderate to strong median longitudinal ridge; lateral longitudinal carina complete, joined to spiracular margin by a short weak carina.

Fore wing length 15–17 mm; discosubmarginal cell as in Fig. 314; AI = 0.64–0.85; CI = 0.28–0.33; ICI = 0.34–0.41; SDI = 1.05; *cu-a* proximal to the base of *Rs&M* by 0.2–0.3 times its own length; marginal cell proximally fairly uniformly hirsute; 1st subdiscal cell anterodistally broadly hirsute. Hind wing with 6–7 hamuli on *R*1; 1st abscissa of *Rs* straight, 2nd abscissa almost straight.

Fore leg with tibia slightly flattened, with fine scattered spines on outer surface. Mid leg with longer tibial spur 1.5–1.6 times length of the shorter. Hind leg with coxa in profile 1.9 times as long as deep;

trochantellus dorsally <0.1 times as long as broad; 4th segment of hind tarsus 2.2 times as long as broad; claws of female quite long with rather close pectinae.

Gaster slender; tergite 2 in profile 5.1–5.6 times as long as posteriorly deep, laterotergite folded under, thyridia elliptical and separated from anterior margin of tergite by about 4 times its own length. Ovipositor concealed, its sheath narrow. Male unknown.

Colour generally orange-brown, with head, pronotum, mesoscutal stripes, upper part of mesopleuron and scutellum yellowish; gaster with tergites 3+ blackish; interocellar area yellowish, with part slightly infuscate, and with an infuscate band extending from median ocellus to between antennal sockets; antenna black; pterostigma yellowish brown; wings slightly yellowish.

VARIATION. None remarkable.

REMARKS. This species is named after Pedro 'Mengo' Mejilla in recognition of his pioneer spirit in establishing the Mengo Biological Station on Volcán Cacao, Costa Rica.

Enicospilus mengoi can be recognized by the form of the alar sclerites – the central sclerite is rather small and circular (see Fig. 314) and by the sculpture on the propodeum. Its relationship with other species is not clearly understood.

BIOLOGICAL INFORMATION. *Enicospilus mengoi* is only known to occur in Costa Rica where two females have been collected at light in forests at altitudes between 700 and 1100 m. Nothing is known about the biology of this insect.

MATERIAL EXAMINED

Holotype ♀, **Costa Rica**: Guanacaste Prov.: 1 ♀, Casa [= Estacion] Mengo, SW. side of Volcán Cacao, 1100 m, vii.1987 (*Janzen*) (BMNH).

Paratype. **Costa Rica**: San José Prov.: 1 ♀, Estacion Carrillo, Braulio Carrillo National Park, 700 m, iv.1985 (*Chacon & Chacon*) (BMNH).

Enicospilus haberi sp. n.

(Fig. 313)

DESCRIPTION. Mandibles moderately long, distally evenly narrowed, apically twisted 40–50°; upper mandibular tooth slightly depressed, 1.5 times as long as the lower tooth; outer mandibular surface flat, with scattered hairs; proximal concavity weak. Labrum 0.3 times as long as broad; malar space 0.2 times as long as basal mandibular width. Clypeus in profile weakly convex, margin blunt; clypeus in front view 1.4–1.5 times as broad as long, the margin apically weakly convex. Lower face 0.68–0.74 times as broad as long, punctate. Head in dorsal view with genae constricted behind eyes; posterior ocellus very close to eye; FI = 75%; occipital carina mediodorsally complete, ventrally curved to join hypostomal carina about 0.8–0.9 times the basal mandibular width away from mandible. Antenna slender, with 58 flagellar segments; 20th segment 2.1–2.2 times as long as broad.

Mesoscutum polished, finely punctate, in profile quite abruptly rounded; notauli weakly impressed near anterior margin. Mesopleuron polished, the upper part punctate, the lower part punctostriate; epicnemial carina inclined towards anterior margin of pleuron, its upper end evanescent. Scutellum in profile weakly convex, laterally carinate for 0.8 of its length; scutellum in dorsal view 1.4 times as long as anteriorly broad, anteriorly smooth, posteriorly with isolated wrinkles. Metapleuron moderately convex, anteroventrally punctate, posterodorsally striate with a few rugae present also; submetapleural carina barely broadened anteriorly; posterior transverse carina of mesosternum complete. Propodeum in profile evenly declivous; anterior transverse carina complete, posterior transverse carina absent; anterior area quite long, striate; spiracular area moderately long, smooth; posterior area irregularly rugose, with the central rugae tending to be longitudinally aligned; lateral longitudinal carina present only anteriorly, joined to spiracular margin by a short carina.

Fore wing length 14–15 mm; discosubmarginal cell as in Fig. 313; AI = 1.00–1.05; CI = 0.26–0.28; ICI = 0.46–0.47; SDI = 1.10–1.23; *cu-a* proximal to the base of *Rs&M* by 0.1–0.2 times its own length; marginal cell proximally slightly more sparsely hirsute than it is centrally; 1st subdiscal cell with scattered hairs centrally and distally. Hind wing with 8 hamuli on *R*1; 1st abscissa of *Rs* almost straight, 2nd abscissa slightly bowed.

Fore leg with tibia slightly flattened, with isolated spines on outer surface. Mid leg with longer tibial spur 1.4–1.5 times length of the shorter. Hind leg with coxa in profile 1.7 times as long as deep; trochantellus dorsally <0.1 times as long as broad; 4th segment of hind tarsus 2.2–2.3 times as long as broad; claws of female abruptly curved, with long close pectinae.

Gaster slender; tergite 2 in profile 6.7–7.2 times as long as posteriorly deep, laterotergite folded under, thyridia shortly elliptical and separated from anterior margin of tergite by about 4–5 times its own length. Ovipositor quite stout, slightly decurved, its sheath slender. Male unknown.

Colour generally orange-brown, with head paler yellow and with mesoscutum bearing three longitudinal dark brown vittae; gaster posteriorly slightly infuscate; interocellar area yellowish; antenna black, with distal apices brownish; pterostigma brown; wings more or less hyaline.

VARIATION. None remarkable.

REMARKS. This species is named in honour of Bill Haber in recognition of his work on Costa Rican insects, and as a gesture of thanks for the numerous ophionines he has collected for this study.

Enicospilus haberi is a rather delicate, small species that can be distinguished from other taxa that have black antennae, a yellow interocellar area and a central sclerite by the fact that the distal sclerite is strongly sclerotized and separated from the proximal sclerite (Fig. 313). Furthermore the proximal sclerite is rather more elongately triangular than that of other species. The entire complex of alar sclerites and fenestra is longer than that of many other species with dark antennae. In this respect *E. haberi* resembles *E. forsythei*, but *E. forsythei* does not have a discrete distal sclerite.

BIOLOGICAL INFORMATION. *Enicospilus haberi* is only known from Monteverde, Costa Rica. The two females were collected at light near the edge of an area of cloud forest at an altitude of 1350 m. Nothing is known of their biology.

MATERIAL EXAMINED

Holotype ♀, **Costa Rica**: Puntarenas Prov., Monteverde, 1350 m, v.1986 (*Haber*) (BMNH).

Paratype. 1 ♀, same locality and collector as holotype, ii.1986 (BMNH).

Enicospilus lacsa sp. n.

(Figs 200, 316, 317, 318, 345)

DESCRIPTION. Mandibles moderately long, quite strongly narrowed, with a weak proximoventral lobe, apically twisted 20–45°; upper mandibular tooth slender, depressed, 1.3–1.6 times as long as the lower tooth; outer mandibular surface bearing isolated pubescence, almost flat. Labrum 0.2–0.3 times as long as broad; malar space 0.2–0.3 times as long as basal mandibular width. Clypeus in profile weakly convex, margin subacute; clypeus in front view quite long, 1.1–1.3 times as broad as long, its margin convex apically. Lower face narrow, 0.61–0.68 times as broad as long, centrally with isolated punctures. Head in dorsal view with genae strongly constricted behind eye; posterior ocellus close to eye; FI = 60–70%; occipital carina mediodorsally complete, ventrally sinuously curved to join hypostomal carina about 0.5–0.7 times the basal mandibular width away from mandible. Antenna very long and slender, with 56–61 flagellar segments; 20th segment 2.5–3.0 times as long as broad.

Mesoscutum polished, finely and sparsely punctate, in profile abruptly rounded and with anterior margin often slightly out-turned; notauli vestigial. Mesopleuron polished, from uniformly punctate to ventrally with traces of punctostriation; epicnemial carina very strong, curved towards anterior margin of pleuron which it almost reaches. Scutellum in profile weakly convex, laterally carinate for 0.5 or more of its length; scutellum in dorsal view 1.4–1.6 times as long as anteriorly broad, punctate with posterior end bearing some longitudinal wrinkles. Metapleuron weakly to moderately convex, generally regularly punctate, occasionally punctostriate; submetapleural carina evenly anteriorly broadened; posterior transverse carina of mesosternum complete, distinctly produced anteriorly centrally so it has a V-shaped notch on midline. Propodeum in profile rather long and weakly declivous posteriorly; anterior transverse carina complete, posterior transverse carina vestigial or absent; anterior area moderately long, striate; spiracular area long, more or less smooth; posterior area rather finely irregularly wrinkled-rugose, with rugae centrally subparallel, longitudinally arranged; lateral longitudinal carina usually more or less complete, rarely interrupted posteriorly, joined to spiracular margin by a short carina.

Fore wing length 12–16 mm; discosubmarginal cell as in Figs 316–318, 345; AI = 0.90–1.68; CI = 0.16–0.46; ICI = 0.35–0.47; SDI = 1.13–1.49; *cu-a* proximal to the base of *Rs&M* by 0.1–0.3 times its own length; marginal cell proximally more or less evenly hirsute; 1st subdiscal cell with distal 0.6 sparsely hirsute. Hind wing with 5–8 hamuli on *R*1; 1st abscissa of *Rs* almost straight, 2nd abscissa more or less straight.

Fore leg with tibia slightly flattened, with scattered fine spines on outer surface. Mid leg with longer tibial spur 1.5–1.7 times length of the shorter. Hind leg with coxa in profile 1.7–1.9 times as long as deep; trochantellus dorsally 0.1 times as long as broad; 4th segment of tarsus 2.0–2.2 times as long as broad; claws of female evenly curved with quite long, moderately close pectinae, those of male similar but with pectinae shorter.

Gaster slender; tergite 2 in profile 5.1–6.9 times as long as posteriorly deep, laterotergite turned under, thyridia elliptical and separated from anterior margin of tergite by about 3–4 times its own length. Ovipositor slender, its sheath narrow. Male with sternite 7 and extreme anterior part of sternite 8 bearing lateral longitudinal rows of close stout erect hairs; remainder of sternite 8 glabrous, with apical margin strongly concave; sternite 9 bearing fine decumbent pubescence (Fig. 200); gonosquama distally rounded.

Colour particularly variable, generally reddish brown, with head paler yellow and gastral tergites 3+ variously infuscate; interocellar area yellowish; antenna from brownish yellow to black; pterostigma brown; wings more or less hyaline.

VARIATION. The most striking variation observable in this species is in colour. The colour pattern described above (reddish brown without mesoscutal vittae and with posterior segments of the gaster blackish) applies to about half the individuals studied. Several of the others are generally paler orange yellow with darker brown mesoscutal vittae, and with the terminal segments of the gaster only indistinctly infuscate. Others are darker, but have discernible mesoscutal vittae. A few individuals have the antennae brownish yellow rather than black.

There is also considerable variation in the size of the alar sclerites. The central sclerite of the specimen from Finca La Selva, Costa Rica, is small and quite slender, and the distal sclerite is absent (Fig. 318). Most other specimens have the central sclerite stouter, but several lack the distal sclerite (Fig. 317), whilst others have it clearly discernible as a small fleck distally.

The specimens from Santa Rosa National Park are somewhat atypical in that they have a slightly longer fenestra, a more heart-shaped central sclerite (Fig. 316) and brown antennae.

REMARKS. This species is named after LACSA, the national airline of Costa Rica in recognition of the quality service rendered to biologists for many years.

Enicospilus lacsa can be distinguished from all other species with black antennae and a yellowish interocellar area by the combination of a comma-shaped central sclerite and the long slender antennae. The only other Central American species that has a similar arrangement of hair on sternites 7–8 is *E. echeverri* and these two species are probably closely related (see that species). Structurally *E. lacsa* also resembles *E. kelloggae* (see that species).

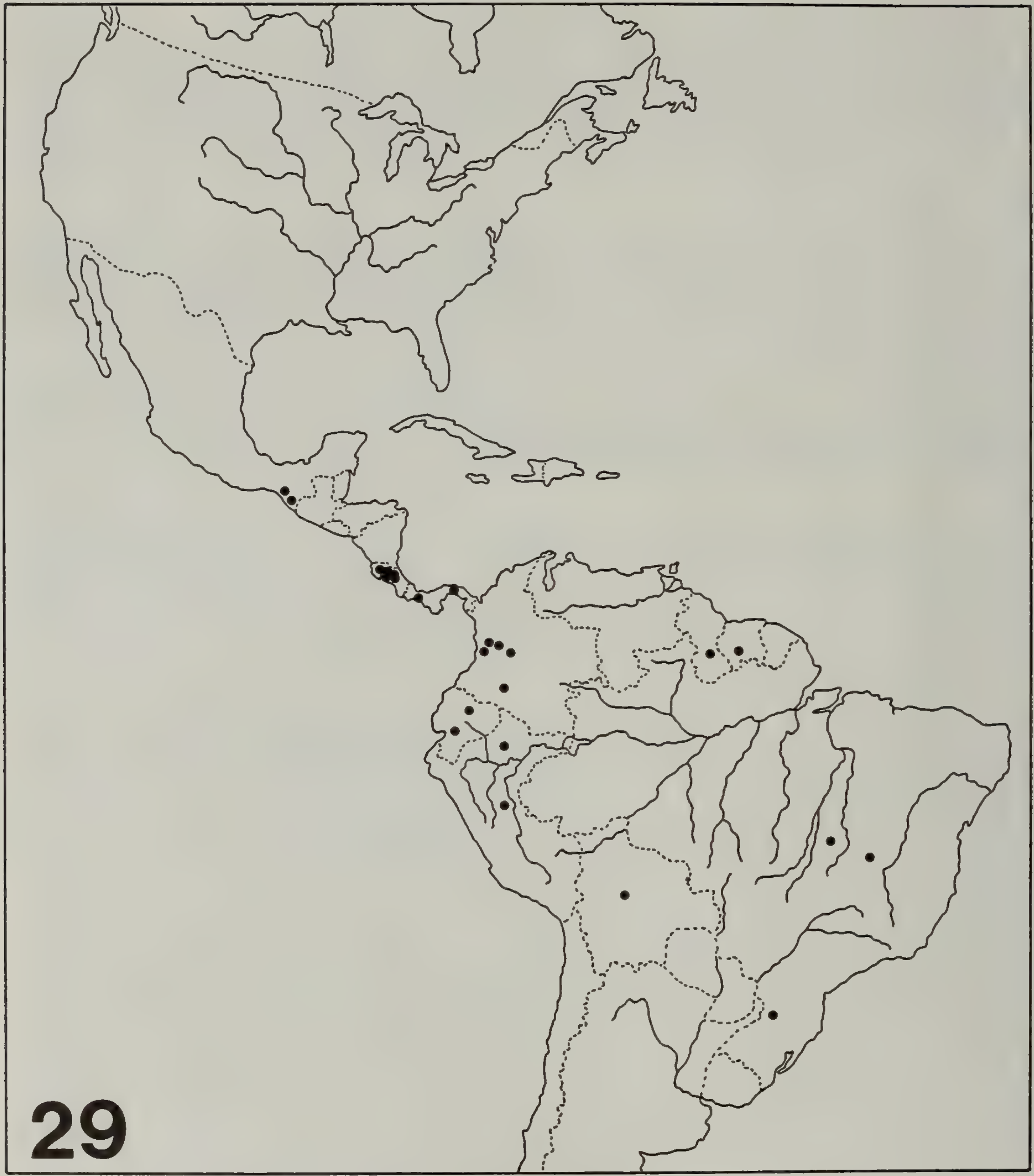
BIOLOGICAL INFORMATION. *Enicospilus lacsa* is a widespread species (Map 29) whose range extends from about 19° in southern Mexico south to Santa Catarina Province in Brazil (27°S). It has been collected at low and medium elevation sites between 100 and 1400 m.

In Central America *E. lacsa* is comparatively rarely collected, and in Santa Rosa National Park only isolated individuals have been taken at the end of the wet season (December-January), later than its relative *E. echeverri*. Nothing is known about the biology of this species.

MATERIAL EXAMINED

Holotype ♂, **Costa Rica**: Heredia Prov., El Angel waterfall, 8.2 km downhill Vara Blanca, 1350 m, i.1981 (*Janzen & Hallwachs*) (BMNH).

Paratypes. **Bolivia**: 1 ♀, Santa Cruz, General Saavedra, xi.1974 (*Porter & Stange*) (FSCA). **Brazil**: 1 ♀, Bahia, Encruzilhada, 980 m, xi.1973 (*Alvarenga*) (TC); 1 ♀, Minas Gerais, Pedra Azul, xi.1970 (*Oliveira*) (TC); Santa Catarina, Nova Teutonia, 27°11'S, 52°23'W, 300–500 m, 1 ♂, ii.1936, 1 ♀, ii.1938, 1 ♂, 1 ♀, xi.1938, 1 ♂, ii.1939, 1 ♂, xii.1968, 1 ♀, i.1966 (*Plaumann*) (BMNH & CNC); same locality, 1 ♀, xi.1952, 2 ♀, i.1953, 1 ♂, 3 ♀, xi-xii.1953, 1 ♀, xi.1970, 1 ♀, iv.1971 (*Plaumann*) (TC). **Colombia**: 1 ♂, Buenaventura, Zabaleta – Río Dagua forest road, 100 m, ix.1971 (*Cooper*) (BMNH); 1 ♂, Caqueta, Florencia, i.1979 (*Cooper*) (BMNH); 1 ♀, Valle, Anchicaya, xii.1977 (*Tidwell*) (FSCA); 1 ♀, Valle, Anchicaya, 30 km E. Buenaventura, tropical wet forest, 560 m, vii.1975 (*Wilkerson*) (FSCA); 1 ♂, 1 ♀, Valle, Río Zabletas, Las Piedras, viii.1975 (*Wilkerson*) (FSCA). **Costa Rica**: Alajuela Prov.: 1 ♂, San Ramón Forestry Reserve, 5 km N. Col. Palmarena, 900 m, v.1985 (*Chacon*) (BMNH); 1 ♀, San Ramón Forestry Reserve, Río San Lorencito, 800 m, iii.1987 (*Chacon*) (BMNH); 1 ♀, Virgen de Socorro, 800 m, ii.1987 (*Janzen & Hallwachs*) (BMNH): Cartago Prov.: 1 ♂, Tapanti, Río Grande de Orosi, 13–1400 m, xi.1982 (*Janzen & Hallwachs*) (BMNH); Cartago Prov.: 1 ♀, Turrialba, iii.1965 (*Duckworth*) (USNM): Guanacaste Prov.: 2 ♀, Santa Rosa National Park, 300 m, xii.1979 (*Janzen*) (TC); same locality, 1 ♂, 1 ♀, i.1983, 1 ♂, i.1984 (*Janzen & Hallwachs*) (BMNH): Heredia Prov.: 1 ♀, Finca La Selva, 3 km S. Puerto Viejo, vii.1986 (*Hespenheide*) (BMNH): Puntarenas Prov.: 3 ♀, Monteverde, 1350 m, vii.1982 (*Janzen & Hallwachs*) (BMNH); 1 ♀, same locality, iii.1986 (*Haber*) (BMNH); 1 ♀, San Vito de C., S. of Las Cruces, 1200 m, vii.1983 (*Gill*) (TC): San José Prov.: 1 ♂, Estacion Carrillo, Braulio Carrillo National Park, 700 m, ix.1984 (*Chacon*) (BMNH); 1 ♂, same locality and collector, i.1985 (BMNH); 1 ♂, 2 ♀, Braulio Carrillo National Park, 500 m, iv.1985 (*Goulet & Masner*) (CNC). **Ecuador**: 1 ♀, Los Ríos, Río Palenque, vi.1974 (*Longino*) (FSCA); 1 ♂, 1 ♀, Pichincha, Santo Domingo, 680 m, v.1975 (*Peck*) (TC); 1 ♀,



Map 29 Localities at which *Enicospilus lacsa* has been collected.

Pichincha, 47 km S. Santo Domingo, Río Palenque Sta., vii.1975 (*Forsyth*) (CNC). **Guyana**: 2 ♀, Essequibo River, Moraballi Creek, viii-x.1929 (BMNH). **Mexico**: Chiapas: 1 ♂, 32 km N. Huixtla, 1000 m, vi.1969 (*Mason*) (CNC); 1 ♀, Muste, nr Huixtla, 440 m, (*Welling*) (CNC). **Panama**: Barro Colorado Island, 1 ♀, iv.1978, 1 ♂, ii.1984, 1 ♀, v.1985 (*Wolda*) (BMNH & RNH); Chiriqui, Fortuna, 1050 m, 2 ♂, i-ii.1978, 1 ♀, iv.1978, 1 ♀, iv.1979 (*Wolda*) (RNH); 1 ♀, Las Cumbres, xii.1981 (*Wolda*) (TC). **Peru**: 2 ♀, Madre de Dios, Avispas, 400 m, ix.1962 (*Peña*) (CNC); 1 ♂, 2 ♀, Quincemil, nr Marcapata, 750 m, xi.1962 (*Peña*) (TC). **Surinam**: 1 ♂, Maratakka River, upper course, iii.1971 (*Geijskes*) (RNH).

Enicospilus brenesiae sp. n.

(Figs 135, 137, 315)

DESCRIPTION. Mandibles long, proximally abruptly narrowed, and with a pronounced proximoventral lobe; mandibles distally parallel-sided, apically twisted 20° (Fig. 137); upper mandibular tooth subcylindrical, 1.2 times as long as the lower tooth; outer mandibular surface with a weak median longitudinal concavity that bears scattered pubescence. Labrum 0.3 times as long as broad; malar space 0.3 times as long as basal mandibular width. Clypeus in profile almost flat, margin blunt; clypeus in front view 1.4 times as broad as long, with margin apically truncate. Lower face 0.83–0.85 times as broad as long, closely and rather coarsely punctate, centrally tending to punctostriate. Head in dorsal view with genae rounded behind eyes; posterior ocellus contiguous with eye; FI = 67%; occipital carina mediodorsally complete, but weak, ventrally curved to join hypostomal carina about 0.6 times the basal mandibular width away from mandible. Antenna slender, with 64–65 flagellar segments; 20th segment 1.5 times as long as broad.

Mesoscutum polished, closely and coarsely punctate, in profile abruptly rounded; notauli vestigial. Mesopleuron polished, the upper part punctate, ventrally grading to punctostriate; epicnemial carina curved towards anterior margin of pleuron, but with its upper end evanescent. Scutellum in profile weakly convex, laterally carinate for 0.8 of its length; scutellum in dorsal view 1.5 times as long as anteriorly broad, punctate. Metapleuron moderately convex, very closely and coarsely punctate (Fig. 135); submetapleural carina narrow, barely broadened anteriorly; posterior transverse carina of mesosternum complete. Propodeum in profile evenly declivous; anterior transverse carina weak, lateromedially discontinuous, posterior transverse carina vestigial; anterior area moderately long, shallow, striate; spiracular area short, punctate; posterior area weakly rugose, the rugae tending to be longitudinal centrally; lateral longitudinal carina absent except for a short anterior vestige, not joined to spiracular margin by a short carina.

Fore wing length 18 mm; discosubmarginal cell as in Fig. 315; AI = 1.00–1.25; CI = 0.37–0.44; ICI = 0.42–0.56; SDI = 1.23–1.29; *cu-a* proximal to the base of *Rs&M* by about 0.1 times its own length; marginal cell proximally broadly glabrous; 1st subdiscal cell with anterior and distal margins sparsely hirsute. Hind wing with 7 hamuli on *R*1; 1st abscissa of *Rs* almost straight, 2nd abscissa weakly arcuate.

Fore leg with tibia slightly flattened, with isolated slender spines on outer surface. Mid leg with longer tibial spur 1.4 times length of the shorter. Hind leg with coxa in profile 1.8 times as long as deep; trochantellus dorsally 0.1 times as long as broad; 4th segment of tarsus 2.3 times as long as broad; claws of female moderately long, with close, stout pectinae.

Gaster quite slender; tergite 2 in profile 4.6 times as long as posteriorly deep, laterotergite folded under, thyridia oval and separated from anterior margin of tergite by about 3.5 times its own length. Ovipositor moderately stout, apically slightly decurved, its sheath narrow. Male unknown.

Colour generally reddish brown, mesoscutum with three blackish vittae; gaster with tergites 3+ dark brown; interocellar area slightly infuscate close to ocelli; antenna basally black, but with flagellum distal to segment 3 brown; pterostigma reddish brown; wings weakly infumate.

REMARKS. This species is named in honour of Liz Brenes for her efforts in the establishment of the education programme at Santa Rosa National Park, Costa Rica.

Enicospilus brenesiae can be recognized most easily by the form of the alar sclerites – the narrowly crescentic central sclerite is very characteristic (Fig. 315), and by the stout mandibles (Fig. 137). It is generally a stouter and more coarsely sculptured species than many others with black antennae.

BIOLOGICAL INFORMATION. *Enicospilus brenesiae* has only been collected during May in cloud forest at 1350 m in Monteverde Reserve, Costa Rica. Nothing is known about its biology.

MATERIAL EXAMINED

Holotype ♀, **Costa Rica**: Puntarenas Prov., Monteverde, 1350 m, v.1980 (*Janzen & Hallwachs*) (BMNH).

Paratype. **Costa Rica**: 1 ♀, same locality as holotype, v.1983 (*Haber*) (BMNH).

Enicospilus forsythei sp. n.

(Figs 201, 202, 320)

DESCRIPTION. Mandibles moderately long, proximally strongly narrowed, distally weakly tapered, apically twisted 20–30°; upper mandibular tooth quite slender, 1.3–1.5 times as long as the lower tooth; outer mandibular surface centrally slightly concave, with a broad shallow proximal concavity, the whole bearing fine sparse pubescence. Labrum 0.2–0.3 times as long as broad; malar space 0.2 times as long as basal mandibular width. Clypeus in profile moderately convex, margin blunt; clypeus in front view 1.3–1.4 times as broad as long, with margin very weakly convex apically. Lower face 0.70–0.75 times as broad as long, laterally punctate, centrally punctostriate. Head in dorsal view with genae constricted behind eyes; posterior ocellus very close to eye; FI = 65–70%; occipital carina mediodorsally complete, ventrally curved to join hypostomal carina about 0.6–0.7 times the basal mandibular width away from mandible. Antenna long and slender, with 53–55 flagellar segments; 20th segment 2.1–2.4 times as long as broad.

Mesoscutum weakly polished, with close shallow punctures, in profile fairly evenly rounded but with anterior margin slightly out-turned; notauli weak. Mesopleuron polished, the upper part finely punctate, the lower part punctostriate; epicnemial carina strong, curved towards anterior margin of pleuron. Scutellum in profile weakly convex, laterally carinate for 0.8 or more of its length; scutellum in dorsal view 1.5 times as long as anteriorly broad, generally smooth, with a few striae posteriorly. Metapleuron weakly convex, anteroventrally puncto-coriaceous becoming weakly rugulose-punctate posterodorsally (Fig. 202); submetapleural carina evenly anteriorly broadened; posterior transverse carina of mesosternum complete. Propodeum in profile evenly declivous; anterior transverse carina sinuous, generally complete, rarely interrupted lateromedially, posterior transverse carina absent; anterior area moderately long, striate; spiracular area short, finely punctate; posterior area coarsely rugose-striate, generally with the rugae more or less concentric (Fig. 201); lateral longitudinal carina present anteriorly, rarely almost complete, not joined to spiracular margin by a short carina.

Fore wing length 15–16 mm; discosubmarginal cell as in Fig. 320; AI = 0.76–1.04; CI = 0.17–0.22; ICI = 0.48–0.53; SDI = 1.00–1.07; *cu-a* usually opposite to the base of *Rs&M* but occasionally proximal to it by 0.1 times its own length; marginal cell proximally uniformly hirsute; 1st subdiscal cell extensively but sparsely hirsute anterodistally. Hind wing with 6–8 hamuli on *R*1; 1st abscissa of *Rs* weakly curved, 2nd abscissa weakly bowed.

Fore leg with tibia slightly flattened, with scattered spines on outer surface. Mid leg with longer tibial spur 1.4–1.5 times length of the shorter. Hind leg with coxa in profile 1.6–1.7 times as long as deep; trochantellus dorsally <0.1 times as long as broad; 4th segment of tarsus 2.5–2.6 times as long as broad; claws of female quite long, apically evenly rounded and bearing moderately long, regularly spaced pectinae; claws of male similar, but with pectinae shorter.

Gaster very slender; tergite 2 in profile 6.1–6.9 times as long as posteriorly deep, laterotergite folded under, thyridia elliptical and separated from anterior margin of tergite by about 4 times its own length. Ovipositor quite stout though with a slender, slightly decurved apex, its sheath narrow. Male with sternites 7–9 bearing very long scattered erect hairs amid shorter, semidecumbent pubescence.

Colour generally reddish brown, with head slightly more yellowish, tergites 3+ of gaster black, often with ventral margin of tergite 3 and sometimes also of 4 yellowish; interocellar area yellowish, generally slightly infuscate between posterior ocelli; antenna black; pterostigma brownish; wings weakly infumate.

VARIATION. A morphologically rather uniform species except for the variation outlined above.

REMARKS. This species is named in honour of Adrian Forsythe for his efforts to raise conservation conciousness in the visitor to Costa Rica.

Enicospilus forsythei may be recognized by the combination of concentrically striate propodeum, weakly twisted mandibles, characteristic alar sclerites (see Fig. 320), alar indices and colour pattern. Structurally it resembles *E. burgosi* and the two species may be closely related.

BIOLOGICAL INFORMATION. *Enicospilus forsythei* is a Central American species whose range extends from southern Mexico to Costa Rica. The Costa Rican specimens have all been collected at a moderate elevation site adjacent to cloud forest.

MATERIAL EXAMINED

Holotype ♀, **Costa Rica**: Puntarenas Prov., Monteverde, ii.1986 (*Haber*) (BMNH).

Paratypes. **Costa Rica**: Puntarenas Prov.: 3 ♀, Monteverde, 1350 m, ix.1985-ii.1986 (*Haber*) (BMNH); 1 ♂, 1 ♀, same locality, i-ii.1986 (*Forsyth*) (CNC). **Mexico**: Chiapas: 1 ♀, 3.2 km NE. Bochil, vi.1969 (*Campbell*) (CNC).

Enicospilus fogdenorum sp. n.

(Figs 203, 204, 321)

DESCRIPTION. Mandibles moderately long, strongly narrowed proximally, with a distinct basal lobe, distally weakly narrowed, apically twisted 35–45°; upper mandibular tooth slender, 1.2–1.5 times as long as and slightly divergent from the lower tooth; outer mandibular surface flat, punctate, bearing fine hairs. Labrum 0.2–0.3 times as long as broad; malar space 0.3 times as long as basal mandibular width. Clypeus in profile almost flat, margin blunt; clypeus in front view 1.4–1.6 times as broad as long, the margin almost truncate apically. Lower face 0.67–0.70 times as broad as long, polished, centrally punctostriate. Head in dorsal view with genae evenly constricted behind eye; posterior ocellus contiguous with eye; FI = 70–75%; occipital carina mediodorsally complete, ventrally curved to join hypostomal carina about 0.5 times the basal mandibular width away from mandible. Antenna long and slender, with 60–65 flagellar segments; 20th segment 1.9–2.0 times as long as broad.

Mesoscutum polished, finely punctate, in profile abruptly rounded; notauli vestigial. Mesopleuron polished, the upper part finely punctate, the lower part similar but with a few wrinkles; epicnemial carina with upper end curved towards anterior margin of pleuron. Scutellum in profile moderately convex, laterally carinate for 0.7 or more of its length; scutellum in dorsal view 1.6–1.7 times as long as anteriorly broad, punctate. Metapleuron posterodorsally with coarse rugae that are confluent with rugae on propodeum, anteroventrally punctate (Fig. 204); submetapleural carina evenly anteriorly broadened; posterior transverse carina of mesosternum complete. Propodeum in profile abruptly declivous; anterior transverse carina complete, posterior transverse carina represented by oblique lateral crests; anterior area quite long, with isolated rugae; spiracular area short, generally rather smooth; posterior area coarsely rugose wrinkled, with three longitudinal rugae centrally (Fig. 203); lateral longitudinal carina only present from anterior margin to just behind anterior transverse carina, behind this absent, anteriorly not joined to spiracular margin by a short carina.

Fore wing length 18–21 mm; discosubmarginal cell as in Fig. 321; AI = 0.70–0.77; CI = 0.25–0.26; ICI = 0.55–0.57; SDI = 1.15–1.17; *cu-a* proximal to the base of *Rs&M* by about 0.2 times its own length; marginal cell proximally fairly uniformly hirsute though with a narrow glabrous area adjacent to *Rs+2r*; 1st subdiscal cell with anterior 0.5 and distal corners hirsute. Hind wing with 8 hamuli on *R*1; 1st and 2nd abscissae of *Rs* straight.

Fore leg with tibia weakly flattened, with fine, scattered spines on outer surface. Mid leg with longer tibial spur 1.5 times length of the shorter. Hind leg with coxa in profile 1.9 times as long as deep; trochantellus dorsally occluded; 4th segment of tarsus 2.3–2.4 times as long as broad; claws of female large, strongly curved with close short pectinae, those of male very similar.

Gaster slender; tergite 2 in profile about 6 times as long as posteriorly deep, laterotergite turned under, thyridia oval and separated from anterior margin of tergite by about 5 times its own length. Female with ovipositor rather stout, apically slender and slightly decurved; ovipositor sheath narrow. Male with sternites 7–9 bearing dense long erect pubescence; gonosquama long, but evenly rounded distally.

Colour generally reddish brown with tergites 3+ blackish; interocellar area yellowish; antenna black, distally brownish; pterostigma brown; wings weakly infumate.

VARIATION. None remarkable.

REMARKS. This species is dedicated to Mike and Tricia Fogden as a gesture of thanks for their hospitality and help collecting specimens at light.

Enicospilus fogdenorum can most easily be recognized by its large size, distinctive colour pattern, propodeal crests and by the presence of a more or less D-shaped central sclerite in the fenestra of the fore wing. *E. fogdenorum* is similar in many features to several other species with black antennae, including *E. erasi*, *E. galilea* and *E. hubbelli*. All have large value of ICI, somewhat similar mesopleural sculpture, claws and male terminal sternites. Of these species, *E. fogdenorum* most closely resembles *E. erasi* which also possesses propodeal crests. It differs from *E. erasi* in colour pattern and in having less twisted mandibles.

BIOLOGICAL INFORMATION. *Enicospilus fogdenorum* is only known to occur in Costa Rica where it has been collected in lower montane cloud forest at Monteverde. Nothing is known of the host range of this species.

MATERIAL EXAMINED

Holotype ♂, **Costa Rica**: Puntarenas Prov., Monteverde, 1300–1400 m, vii.1982 (*Janzen & Hallwachs*) (BMNH).

Paratype. 1 ♀, same locality and collectors, 1500 m, i.1984 (BMNH).

Enicospilus burgosi sp. n.

(Figs 138, 205, 322, 343)

DESCRIPTION. Mandibles moderately long, proximally strongly constricted, distally weakly narrowed, apically twisted 25–35°; upper mandibular tooth slightly depressed, quite slender, 1.3–1.5 times as long as the lower tooth; outer mandibular surface with a broad shallow proximal concavity that continues distally into a weakly concave area extending about half way along the mandible, and with this area sparsely pubescent; upper edge of mandible often margined by a very weak ridge. Labrum 0.2–0.3 times as long as broad; malar space 0.3–0.4 times as long as basal mandibular width. Clypeus in profile weakly convex, margin blunt; clypeus in front view 1.2–1.4 times as broad as long, with margin subtruncate apically. Lower face 0.66–0.77 times as broad as long, centrally sparsely punctate. Head in dorsal view with genae rounded behind eyes; posterior ocellus close to eye; FI = 60–70%; occipital carina mediodorsally complete, ventrally curved to join hypostomal carina about 0.6–0.7 times the basal mandibular width away from mandible. Antenna long and slender, with 52–57 flagellar segments; 20th segment 1.8–2.3 times as long as broad.

Mesoscutum polished, finely punctate, in profile abruptly rounded with margin out-turned; notauli weakly impressed anteriorly. Mesopleuron polished, the upper part punctate, the lower part grading from punctate to punctostriate to striate; epicnemial carina inclined towards anterior margin of pleuron, with its upper end evanescent. Scutellum in profile weakly convex, usually laterally carinate for 0.8 or more of its length; scutellum in dorsal view 1.4–1.5 times as long as anteriorly broad, smooth, with isolated punctures, but with a few wrinkles posteriorly. Metapleuron weakly convex, diagonally striate or coriaceous to coriaceous-striate (Fig. 205); submetapleural carina fairly evenly broadened anteriorly; posterior transverse carina of mesosternum complete. Propodeum in profile evenly rounded; anterior transverse carina complete, posterior transverse carina absent; anterior area quite long, striate; spiracular area fairly short, smooth with fine punctures; posterior area rugose-reticulate to rugose-striate, with the rugae tending to be concentric posteriorly; lateral longitudinal carina present before anterior transverse carina, incomplete posteriorly, joined to spiracular margin by a short carina.

Fore wing length 11–15 mm; discosubmarginal cell as in Figs 322, 343; AI = 0.90–1.05; CI = 0.18–0.26; ICI = 0.38–0.49; SDI = 1.08–1.26; *cu-a* proximal to the base of *Rs&M* by 0.1–0.2 times its own length; marginal cell proximally sparsely to very sparsely pubescent; 1st subdiscal cell with anterodistal half hirsute. Hind wing with 4–7 hamuli on *R*1; 1st abscissa of *Rs* straight, 2nd abscissa weakly curved.

Fore leg with tibia weakly flattened, with fine, scattered spines on outer surface. Mid leg with longer tibial spur 1.4–1.7 times length of the shorter. Hind leg with coxa in profile 1.6–1.8 times as long as deep; trochantellus dorsally 0.1–0.4 times as long as broad (Fig. 138); 4th segment of tarsus 1.8–2.4 times as long as broad; claws of female moderately long, abruptly curved, with regular, moderately long pectinae, those of male similar but with pectinae shorter.

Gaster slender; tergite 2 in profile 6.0–7.0 times as long as posteriorly deep, laterotergite folded under, thyridia elliptical and separated from anterior margin of tergite by about 4–5 times its own length. Ovipositor slender, its sheath narrow. Male with sternites 7–9 usually bearing scattered long, slightly curved, erect hairs; gonosquama slender, distally almost pointed.

Colour generally brownish yellow, with mesoscutal vittae dark brown, and with posterior tergites of gaster from very weakly to strongly infuscate; interocellar area yellowish; antenna brown to black; pterostigma brownish; wings hyaline.

VARIATION. This is a morphologically rather variable species and possibly several taxa may be confused under a single name here. The typical form is exhibited by the Costa Rica specimens from Santa Rosa National Park. These have the hind trochantellus longer than other individuals, have a ventrally striate mesopleuron, have the fenestra quite long and with a virtually indistinguishable distal sclerite, have elongate pubescence on the male terminal sternites and have the metapleuron coriaceous-striate. Several have the antenna basally brownish, though most usually it is black. The Brazilian specimens have the hind trochantellus dorsally shorter (0.1–0.2 times as long as broad), the metapleuron more finely striate and the distal sclerite discernible. A pair from Belize and a male from Santa Rosa differ in having the mesopleuron almost entirely punctate, the fenestra margined by a strong distal sclerite; the males have rather fine decumbent hair on the posterior sternites. A male from Braulio Carrillo National Park, Costa Rica, has short lateral carinae on the propodeum, and the posterior sternites bear dense long erect pubescence. I am not certain that all these individuals are conspecific, but until more material is available it seems reasonable, at present, to include all together, though I have excluded the more atypical specimens from the paratype series.

REMARKS. This species is named in honour of Señor Mario Burgos for his patience in the development of Guanacaste National Park.

Enicospilus burgosi can be recognized by the venation and by the mandibles which have a weak but characteristic ridge along their upper margin.

BIOLOGICAL INFORMATION. *Enicospilus burgosi* is a widely distributed but rarely collected species whose range extends from Belize to southern Brazil. It has been collected from sea level up to about 1000 m.

In Costa Rica most specimens have been collected in seasonally dry forest in Santa Rosa National Park, the majority, between April (the end of the dry season) and July (well into the beginning of the wet season), though an aberrant male was taken in January. The cumulative seasonal data for this site are:

J	F	M	A	M	J	J	A	S	O	N	D
1	–	–	3	1	3	3	–	–	1	–	–

Nothing is known of the biology of this species.

Material Examined

Holotype ♂, **Costa Rica**: Guanacaste Prov., Santa Rosa National Park, 300 m, vii.1984 (*Janzen & Hallwachs*) (BMNH).

Paratypes. **Belize**: 1 ♀, Augustine, vii.1968 (*Hasse*) (BMNH). Costa Rica: Guanacaste Prov.: 3 ♀, Santa Rosa National Park, 300 m, vii & x.1977 (*Janzen*) (TC); 1 ♂, same locality, x.1982 (*Janzen & Hallwachs*) (BMNH); 1 ♀, same locality, iv.1983 (*Janzen & Hallwachs*) (BMNH); 2 ♀, same locality, iv.1984 (*Gauld*) (BMNH); 1 ♀, same locality, v.1984 (*Janzen & Hallwachs*) (BMNH); 3 ♀, same locality vi.1985 (*Gauld*) (BMNH).

Non-paratypic material. **Belize**: 1 ♂, 1 ♀, Middlesex, 125 m, v.1963 (*Welling*) (CNC). **Brazil**: 2 ♀, Bahia, Encruzilhada, 980 m, xi.74 (*Alvarenga*) (TC); 1 ♀, Santa Catarina, Nova Teutonia, xi.1970 (*Plaumann*) (TC). **Costa Rica**: Guanacaste Prov.: 1 ♂, Santa Rosa National Park, 300 m, i.1984 (*Janzen & Hallwachs*) (BMNH): Puntarenas Prov.: 1 ♂, Finca Las Cruces, 6 km S. San Vito de Java, 1400 m, ix.1986 (*Eger*) (BMNH): San José Prov.: 1 ♂, 1 ♀, Estacion Carrillo, Braulio Carrillo National Park, 700 m, ii-iii.1985 (*Chacon*) (BMNH).

Enicospilus erasi sp. n.

(Figs 134, 136, 217, 323)

Description. Mandibles moderately long, distally fairly strongly but evenly narrowed, apically twisted 55–75° (Fig. 136); upper mandibular tooth slightly depressed, 1.4–1.5 times as long as the lower tooth; outer mandibular surface with a weak ridge running from upper proximal corner to near base of upper tooth, the part below this ridge slightly concave and bearing scattered hairs (Fig. 217). Labrum 0.2 times as long as broad; malar space 0.3 times as long as basal mandibular width. Clypeus in profile weakly convex to almost flat, margin subacute; clypeus in front view 1.3–1.4 times as broad as long, the margin apically truncate. Lower face 0.63–0.66 times as broad as long, centrally sparsely punctate. Head in dorsal view with genae constricted behind eyes; posterior ocellus contiguous with eye; FI = 75%; occipital carina mediodorsally complete, ventrally curved to join hypostomal carina about 0.7 times the basal mandibular width away from mandible. Antenna slender, with 63–64 flagellar segments; 20th segment 1.7–2.0 times as long as broad.

Mesoscutum polished, finely punctate, in profile abruptly rounded; notauli weakly impressed anteriorly. Mesopleuron polished, the upper part punctate, the lower part striate; epicnemial carina curved towards anterior margin of pleuron. Scutellum in profile weakly convex, laterally carinate for 0.5–0.7 of its length; scutellum in dorsal view 1.5 times as long as anteriorly broad, anteriorly sparsely punctate, posteriorly with weak longitudinal wrinkles. Metapleuron moderately convex, diagonally striate with coarse rugae present posterodorsally (Fig. 134); submetapleural carina narrow, rather abruptly broadened anteriorly; posterior transverse carina of mesosternum complete, but weak centrally. Propodeum in profile abruptly declivous; anterior transverse carina complete, posterior transverse carina present as vestigial keels laterally; anterior area quite long, striate; spiracular area short, almost smooth; posterior area coarsely irregularly rugose-reticulate, with rugae tending to be longitudinal centrally; lateral longitudinal carina posteriorly incomplete, joined or not joined to spiracular margin by a short carina.

Fore wing length 18–20 mm; discosubmarginal cell as in Fig. 323; AI = 0.76–0.84; CI = 0.25–0.28; ICI = 0.87–0.97; SDI = 1.21–1.36; *cu-a* proximal to the base of *Rs&M* by 0.2–0.3 times its own length; marginal cell proximally rather sparsely hirsute adjacent to *Rs+2r*; 1st subdiscal cell distally hirsute. Hind wing with 8 hamuli on *R*1; 1st abscissa of *Rs* almost straight, 2nd abscissa weakly bowed.

Fore leg with tibia weakly flattened, with isolated spines on outer surface. Mid leg with longer tibial spur 1.5–1.6 times length of the shorter. Hind leg with coxa in profile 1.8 times as long as deep; trochantellus dorsally 0.1 times as long as broad; 4th segment of tarsus 2.3–2.4 times as long as broad; claws of female abruptly curved, stout, with many, close pectinae; claws of male similar but with pectinae shorter.

Gaster slender; tergite 2 in profile 5.4–5.6 times as long as posteriorly deep, laterotergite folded under, thyridia more or less circular and separated from anterior margin of tergite by about 7 times its own length. Ovipositor apically slender, its sheath narrow. Male with sternites 7–9 bearing long close erect pubescence; gonosquamae long, distally tapered, apically rounded.

Colour generally golden yellowish brown, with mesoscutal vittae blackish and distal segments of gaster slightly infuscate; interocellar area brownish yellow; antenna black dorsally near bases, distally paler brownish; pterostigma brown; wings weakly infumate.

Variation. One specimen from Panama has the gaster slightly darker than the other, but this individual is extremely dirty, and its true colour may not be apparent. The Costa Rican specimen has the head and much of the alitrunk quite bright yellowish, weak scutellar carinae and the lateral carina of the propodeum is more or less complete.

Remarks. This species is named in honour of Alejandro Eras for his tireless efforts to protect Guanacaste National Park, Costa Rica.

Enicospilus erasi can most easily be recognized by the twisted, ridged mandible (Fig. 217), the large value of ICI and the characteristic alar sclerites (Fig. 323). *E. erasi* may be confused with *E. galilea* and *E. hubbelli* which it superficially resembles. Both *E. galilea* and *E. erasi* have the anterior margin of vein *Rs+2r* almost straight (Figs 323, 324), not weakly centrally bowed like that of *E. hubbelli* (Fig. 325), and *E. hubbelli* has the posterior area of the propodeum more regularly concentrically striate. The differences between *E. galilea* and *E. erasi* are, however, more subtle. The former has weakly twisted, stout mandibles and lacks propodeal crests, whilst *E. erasi* has quite strongly tapered mandibles twisted 55° or more, and distinct lateral crests present on the propodeum.

Biological Information. *Enicospilus erasi* is only known to occur in Costa Rica and Panama where two specimens have been collected at black light, at 1050 m in Fortuna (8°12'N, 82°13'W), northern Panama during February and April, and a third taken in rainforest at 800 m in Costa Rica. Nothing is known about the natural history of this species.

Material Examined

Holotype ♂, **Costa Rica**: Alajuela Prov., Virgen de Socorro, 800 m, ii.1987 (*Janzen & Hallwachs*) (BMNH).

Paratypes. **Panama**: 1 ♀, Chiriqui, Fortuna, 1050 m, ii.1978 (*Wolda*) (RNH); 1 ♀, same locality, iv.1978 (*Wolda*) (RNH).

Enicospilus galilea sp. n.

(Fig. 324)

Description. Mandibles stout, moderately long, weakly and evenly narrowed, apically twisted 25–35°; upper mandibular tooth quite slender, subcylindrical, 1.2–1.4 times as long as the compressed and slightly broader lower tooth; outer mandibular surface bearing fine scattered hairs, more or less flat centrally, but with a distinct shallow proximoventral concavity. Labrum 0.4–0.5 times as long as broad; malar space 0.2–0.3 times as long as basal mandibular width. Clypeus in profile weakly convex, margin blunt; clypeus in front view 1.4–1.6 times as broad as long, with margin subtruncate apically. Lower face 0.69–0.74 times as broad as long, centrally finely and closely punctate. Head in dorsal view with genae rounded behind eyes; posterior ocellus contiguous with eye; FI = 67–73%; occipital carina mediodorsally complete or narrowly interrupted, ventrally curved to join hypostomal carina about 0.7–0.8 times the basal mandibular width away from mandible. Antenna long and slender, with 64–66 flagellar segments; 20th segment 2.0–2.1 times as long as broad.

Mesoscutum polished, virtually impunctate, in profile evenly rounded; notauli weak but discernible anteriorly. Mesopleuron polished, the upper part punctate, the lower part punctate with transverse rugae or striae present; epicnemial carina strongly curved towards, but generally not reaching, anterior margin of pleuron. Scutellum in profile moderately convex, laterally carinate for 0.8 or more of its length; scutellum in dorsal view 1.3–1.4 times as long as anteriorly broad, anteriorly punctate, somewhat rugose posteriorly. Metapleuron weakly convex, but posterodorsally raised, this raised part being transversely rugose to striate, the flatter anteroventral part being punctate; submetapleural carina weakly broadened anteriorly; posterior transverse carina of mesosternum complete. Propodeum in profile abruptly declivous; anterior transverse carina centrally complete, its lateral extremities obsolescent, posterior transverse carina absent; anterior area short, steep, striate; spiracular area quite long, more or less smooth; posterior area coarsely irregularly rugose-reticulate; lateral longitudinal carina usually present anteriorly as a vestige, its extreme anterior end usually joined to spiracular margin by a weak carina.

Fore wing length 19–21 mm; discosubmarginal cell as in Fig. 324); AI = 0.77–1.32; CI = 0.35–0.48; ICI = 0.54–0.68; SDI = 1.31–1.42; *cu-a* proximal to the base of *Rs&M* by 0.1–0.3 times its own length; marginal cell proximally distinctly more sparsely hirsute than it is centrally; 1st subdiscal cell anteriorly and distally broadly hirsute. Hind wing with 7–10 hamuli on *R*1; 1st abscissa of *Rs* straight, 2nd abscissa weakly bowed.

Fore leg with tibia slightly flattened, with scattered inconspicuous spines on outer surface. Mid leg with longer tibial spur 1.3–1.6 times length of the shorter. Hind leg with coxa in profile 1.7–1.8 times as long as deep; trochantellus dorsally <0.1 times as long as broad; 4th segment of hind tarsus 2.4–2.5 times as long as broad; claws of female moderately long, apically abruptly rounded, with fine close pectinae; those of male similar.

Gaster long and slender; tergite 2 in profile 6.0 or more times as long as posteriorly deep, laterotergite folded under, thyridia elliptical and separated from anterior margin of tergite by about 3.5–4.0 times its own length. Ovipositor slender, its sheath narrow. Male with sternites 7–9 bearing very dense long stout pubescence; gonosquama apically rounded.

Colour generally with head and alitrunk yellowish, the mesoscutum bearing three longitudinal black vittae; legs, propodeum dorsally and gaster darker brownish yellow; interocellar area yellow or slightly infuscate; antenna proximally black, distally becoming blackish brown or even brown; pterostigma golden; wings more or less hyaline.

VARIATION. Most specimens have the alar sclerites similar to those illustrated, but in some individuals the distal sclerite is evanescent distally, or even occasionally totally indistinct.

REMARKS. This species is named after the Hotel Galilea, San José, Costa Rica, provider of first-rate hospitality for tropical biologists over the years.

Enicospilus galilea is similar in general appearance to and likely to be confused with *E. erasi* (p. 269).

BIOLOGICAL INFORMATION. *Enicospilus galilea* is a Mesoamerican species that is known to occur from Belize south to Central Panama. It has been collected from sea-level up to about 1300 m. Nothing is known about the natural history of this species.

MATERIAL EXAMINED

Holotype ♀, **Costa Rica**: Guanacaste Prov., Santa Rosa National Park, 300 m, i.1984 (*Janzen & Hallwachs*) (BMNH).

Paratypes. **Belize**: 1 ♀, Middlesex, 125 m, iii.1965 (*Welling*) (CNC). **Costa Rica**: Cartago Prov.: 1 ♀, Turrialba, 700 m, vii.1965 (*Real*) (CAS): Guanacaste Prov.: 1 ♀, Estacion Mengo on SW. side of Volcán Cacao, 1100 m, vii.1987 (*Janzen & Hallwachs*) (BMNH): Puntarenas Prov.: 2 ♀, Monteverde, 1300 m, ix.1985, vi.1986 (*Haber*) (BMNH). **Panama**: 1 ♂, Barro Colorado Island, 120 m, viii.1983 (*Wolda*) (BMNH).

Enicospilus hubbelli sp. n.

(Figs 207, 208, 325)

DESCRIPTION. Mandibles moderately stout, quite long, distally moderately strongly and evenly narrowed, apically twisted 35–45° (Fig. 208); upper mandibular tooth quite slender, subcylindrical, 1.2–1.4 times as long as the compressed and very slightly broader lower tooth; outer mandibular surface bearing long fine scattered hairs, more or less flat centrally, but with a distinct shallow and rather finely pubescent proximoventral concavity. Labrum 0.3–0.4 times as long as broad; malar space 0.2–0.3 times as long as basal mandibular width. Clypeus in profile weakly convex, margin blunt; clypeus in front view 1.4–1.6 times as broad as long, with margin subtruncate apically. Lower face 0.70–0.76 times as broad as long, centrally finely and closely punctate. Head in dorsal view with genae rounded behind eyes; posterior ocellus contiguous with eye; FI = 70–75%; occipital carina mediodorsally complete, ventrally curved to join hypostomal carina about 0.7–0.8 times the basal mandibular width away from mandible. Antenna long and slender, with 59–64 flagellar segments; 20th segment 1.8–2.0 times as long as broad.

Mesoscutum polished, virtually impunctate, in profile evenly rounded; notauli weak but discernible anteriorly. Mesopleuron polished, the upper part punctate to punctostriate, the lower part punctate with transverse rugae or striae present; epicnemial carina strongly curved towards, but generally not reaching, anterior margin of pleuron. Scutellum in profile moderately convex, laterally carinate for 0.8 or more of its length; scutellum in dorsal view 1.3–1.4 times as long as anteriorly broad, anteriorly punctate, somewhat rugose posteriorly. Metapleuron quite strongly convex, punctate anteroventrally, posterodorsally with isolated irregular rugae; submetapleural carina weakly broadened anteriorly; posterior transverse carina of mesosternum complete. Propodeum in profile abruptly declivous; anterior transverse carina sinuous, centrally complete, though often weak, its lateral extremities always obsolescent, posterior transverse carina absent; anterior area moderately long, steep, striate; spiracular area short, finely and closely punctate; posterior area more or less concentrically rugose-striate, the striae tending to become longitudinal on midline (Fig. 207); lateral longitudinal carina fine but present, usually joined to spiracular margin by a short carina.

Fore wing length 19–21 mm; discosubmarginal cell as in Fig. 325; AI = 0.62–0.78; CI = 0.36–0.41; ICI = 0.78–0.83; SDI = 1.25–1.46; *cu-a* proximal to the base of *Rs&M* by 0.1–0.2 times its own length; marginal cell proximally from evenly hirsute to narrowly glabrous; 1st subdiscal cell anteriorly and distally broadly hirsute. Hind wing with 9–10 hamuli on *R*1; 1st abscissa of *Rs* straight, 2nd abscissa weakly bowed.

Fore leg with tibia slightly flattened, with scattered slender spines on outer surface. Mid leg with longer tibial spur 1.4–1.6 times length of the shorter. Hind leg with coxa in profile 1.8–1.9 times as long as deep; trochantellus dorsally <0.1 times as long as broad; 4th segment of tarsus 2.2–2.4 times as long as broad; claws of female moderately long, apically abruptly rounded, with fine close pectinae.

Gaster from rather stout to long and slender; tergite 2 in profile 4.1–6.8 times as long as posteriorly deep, laterotergite folded under, thyridia oval and separated from anterior margin of tergite by about 4.5–4.9 times its own length. Ovipositor slender, its sheath narrow. Male unknown.

Colour generally with head and alitrunk yellowish, the mesoscutum bearing three longitudinal black vittae; legs, propodeum dorsally and gaster darker brownish yellow; interocellar area yellow or slightly infuscate; antenna almost entirely black, extreme distal apex pale brown; pterostigma golden; wings more or less hyaline.

VARIATION. None remarkable.

REMARKS. This species is named in honour of Steve Hubbell in recognition of his unflagging interest in tropical tree biology.

Enicospilus hubbelli is similar to *E. galilea* and *E. erasi* (see the remarks under the last species).

BIOLOGICAL INFORMATION. *Enicospilus hubbelli* is only known to occur in Panama where it has been collected in lowland rainforest on Barro Colorado Island. Nothing is known about its biology.

MATERIAL EXAMINED

Holotype ♀, **Panama**: Barro Colorado Island, 120 m, vii.1985 (*Wolda*) (BMNH).

Paratypes. **Panama**: 3 ♀, Barro Colorado Island, 120 m, vi & x.1984, vii.1985 (*Wolda*) (BMNH).

Enicospilus flavoscutellatus (Brullé)

(Figs 206, 215, 326)

Ophion flavo-scutellatus Brullé, 1846: 140. Holotype ♂, BRAZIL (MNHN) [examined].
Ophion thoracicus Cresson, 1865: 55. LECTOTYPE ♀, CUBA, (PANS) here designated [examined]. [Synonymized by Townes & Townes, 1966: 177.]
Ophion trimaculatus Taschenberg, 1875: 433. Holotype ♀, BRAZIL (Halle). [Synonymized by Townes & Townes, 1966: 177.]
Ophion (*Enicospilus*) *flavo-scutellatus* Brullé; Cameron, 1886: 291.
[*Ophion* (*Enicospilus*) *concolor* Cresson; Cameron, 1886: 291. Misidentification.]
Enicospilus thoracicus (Cresson) Ashmead, 1900b: 271.
Henicospilus flavoscutellatus (Brullé) Dalla Torre, 1901: 181.
Henicospilus thoracicus (Cresson) Dalla Torre, 1901: 184.
Henicospilus trispilus Szépligeti, 1906: 145. LECTOTYPE ♂, VENEZUELA, (TM) here designated [examined]. **Syn. n.**
Enicospilus flavo-scutellatus (Brullé) Hooker, 1912: 68.
Enicospilus trispilus (Szépligeti) Hooker, 1912: 90.
Henicospilus trimaculatus (Taschenberg) Morley, 1912: 35.
Henicospilus attritus Enderlein, 1921: 33. Holotype ♂, PERU (IZPAN) [examined]. **Syn. n.**
Enicospilus attritus (Enderlein) Townes & Townes, 1966: 175.
Enicospilus flavoscutellatus (Brullé); Townes & Townes, 1966: 177.

DESCRIPTION. Mandibles long, proximally moderately narrowed, distally broad and more or less parallel-sided, apically twisted 15–25°; upper mandibular tooth compressed, 1.2–1.6 times as long as the lower tooth; outer mandibular surface bearing long fine sparse hairs, distally flat to slightly concave and proximally with a weak ventrobasal concavity. Labrum 0.3–0.4 times as long as broad; malar space 0.3–0.4 times as long as basal mandibular width. Clypeus in profile moderately to quite strongly convex, margin generally subacute; clypeus in front view 1.3–1.5 times as broad as long, with margin subtruncate or weakly convex apically. Lower face 0.73–0.78 times as broad as long, polished, punctate. Head in dorsal view with genae constricted behind the eyes; posterior ocellus close to eye; FI = 65–70%; occipital carina mediodorsally complete, ventrally curved to join hypostomal carina about 0.6–0.8 times the basal mandibular width away from mandible. Antenna long and slender, with 60–65 flagellar segments; 20th segment 2.1–2.4 times as long as broad.

Mesoscutum polished, almost impunctate, in profile evenly rounded (Fig. 206); notauli vestigial. Mesopleuron highly polished, the upper part very finely punctate, the lower part similar but with occasional wrinkles ventrally; epicnemial carina inclined towards anterior margin of pleuron. Scutellum in profile weakly convex, laterally carinate for 0.7 or more of its length (Fig. 215); scutellum in dorsal view

1.4–1.6 times as long as anteriorly broad, polished and punctate, occasionally wrinkled posteriorly. Metapleuron moderately convex, highly polished and punctate finely; submetapleural carina evenly broadened; posterior transverse carina of mesosternum complete. Propodeum in profile evenly declivous; anterior transverse carina complete, posterior transverse carina usually absent, rarely represented laterally; anterior area long, striate; spiracular area quite short, smooth; posterior area generally rather weakly and irregularly rugose, often with the rugosities very weak so the surface is nearly smooth, very rarely almost reticulate, but in each case a more or less distinct median longitudinal wrinkle is usually discernible, and occasionally this may be particularly strong, resembling a carina; lateral longitudinal carina complete, joined to spiracular margin by a short carina.

Fore wing length 15–20 mm; discosubmarginal cell as in Fig. 326; AI = 0.71–0.77; CI = 0.27–0.39; ICI = 0.44–0.54; SDI = 1.06–1.18; *cu-a* proximal to the base of *Rs&M* by 0.1–0.3 times its own length; marginal cell proximally more or less evenly hirsute; 1st subdiscal cell with distal margin broadly hirsute. Hind wing with 5–7 hamuli on *R*1; 1st abscissa of *Rs* straight, 2nd abscissa more or less straight.

Fore leg with tibia slightly flattened, with slender, scattered spines on outer surface. Mid leg with longer tibial spur 1.4–1.5 times length of the shorter. Hind leg with coxa in profile 1.8–1.9 times as long as deep; trochantellus dorsally 0.1–0.2 times as long as broad; 4th segment of tarsus 2.2–2.5 times as long as broad; claws of female moderately long, distally abruptly curved, bearing fine, close pectinae; claws of male similar but with pectinae slightly finer and shorter.

Gaster long and slender; tergite 2 in profile more than 6.5 times as long as posteriorly deep, laterotergite folded under, thyridia elliptical and separated from anterior margin of tergite by about 2–4 times its own length. Ovipositor slender, its sheath narrow. Male with sternites 7–9 bearing fine decumbent pubescence, but with pubescence denser and more erect on posteromedian margin of sternites 7–8; gonosquama apically rounded.

Colour rather variable but most generally quite brightish yellow with mesoscutum bearing three dark longitudinal vittae; gaster usually with upper and lower margins of segments 3–5 slightly infuscate and tergite 6+ more uniformly weakly infuscate; interocellar area yellow; antenna golden; pterostigma brownish yellow; wings hyaline.

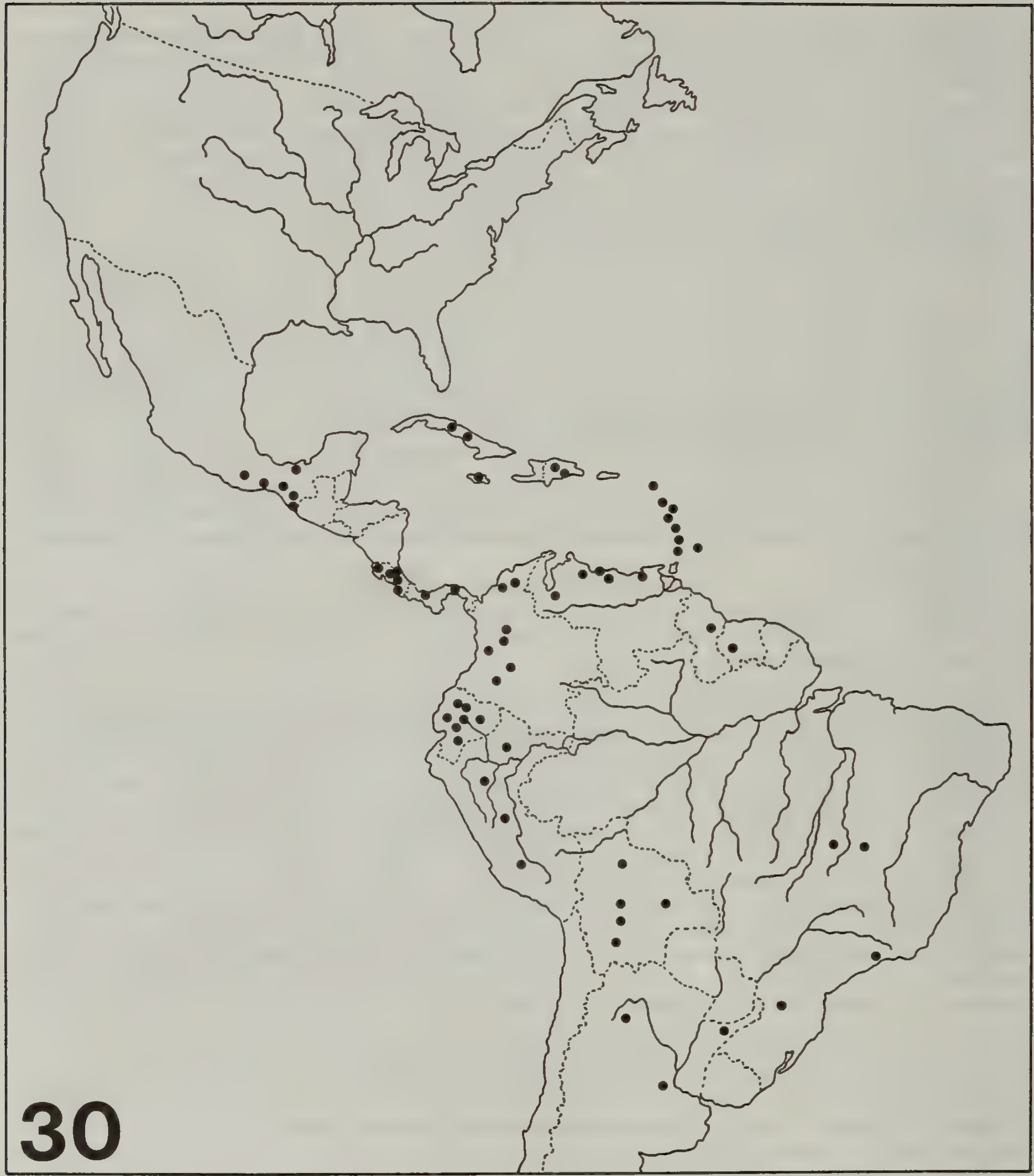
VARIATION. *Enicospilus flavoscutellatus* exhibits a considerable range of colour variation. Many individuals from lowland 'disturbed' sites are more or less entirely yellowish with the mesoscutal vittae slightly darker brown. Individuals from higher altitude sites (1200+ m) tend to be more extensively dark-marked than the norm, having additionally dark areas on the posterodorsal corner of the mesopleuron, mesosternum, metanotum and posterior area of the propodeum. Quite often specimens have the central part of tergites 3–5 pale and the periphery dark so the gaster appears banded or mottled in side view. Occasional specimens are generally darker brownish.

One series of individuals collected at 2200 m at Guadelupe Arriba, Panama, are very distinctive in being smooth and extremely highly polished, and in having distinct lateral parts of the posterior transverse carina of the propodeum, the lower corner of the epicnemial carina acute, the petiole black and whitish marks on the scutellum, mesopleuron, face and gena. These individuals also have the wings weakly infumate and the flagellum distally infuscate, but with the extreme apex pale. These individuals closely resemble the holotype of *E. attritus*, and I consider them all to be conspecific with typical examples of *E. flavoscutellatus*.

REMARKS. Townes & Townes (1966: 178) state that in 1916 Cresson designated a lectotype for *Ophion thoracicus*. However, Cresson's collective designation of numerous lectotypes in this paper is invalid under the *Code* (Article 74c). Cresson stated that the [lecto]type was specimen '77 Cuba'. In the collection of the Philadelphia Academy I could find only a single specimen (number 77.1) labelled as 'type' and this is the specimen I here designate as lectotype.

The form of the alar sclerites, in particular the elongate central sclerite, make *E. flavoscutellatus* one of the most distinctive and easily recognizable Neotropical species (Fig. 326). The structure of the mandibles and the rather polished appearance are also distinctive but require experience to appreciate. Otherwise, in structure, this is a rather unexceptional species. Morphologically, it most closely resembles *E. devriesi* (see that species) and an undescribed Argentinian/Southern Brazilian species which differs only in having a small circular central sclerite.

BIOLOGICAL INFORMATION. *Enicospilus flavoscutellatus* is a widespread Neotropical species (Map 30) whose range extends from about 18°N in southern Mexico south throughout Central and South America to southern Brazil and northern Argentina (*ca* 28°S) where it is apparently gradually replaced by a closely related species. *E. flavoscutellatus* has been taken in a wide variety of habitat types from about 300 m up to about 2300 m in Central America, and up to 3000 m in the Andes. At such high altitudes it is rather scarce, and it comprises a much smaller proportion of the total light-trap catch than does its close relative *E.*



Map 30 Localities at which *Enicospilus flavoscutellatus* has been collected.

devriesi. These two species are sympatric between 1200 and 2300 m, but at these lower elevation sites *E. flavoscutellatus* is much more frequently collected than *E. devriesi*.

E. flavoscutellatus is one of the commonest nocturnal ichneumonids in lower montane forests in Central America. At many sites individuals are extremely abundant, often outnumbering all other species combined and literally hundreds of specimens have been collected at Monteverde, between January and April. It has been collected at almost every mid-altitude site that has been sampled, though it is absent from high altitude sites (2500+ m) in Costa Rica. In Costa Rica this species has been collected at the following sites: Finca Campana at 5 km NW. Dos Ríos, Finca San Gabriel at 3 km W. of Dos Ríos and Virgen de Socorro in Alajuela Province; 16 km S. San Isidro de Tejar, Tapanti, Turrialba and Volcán Irazú in Cartago Province; Cerro el Hacha, Rincón de la Vieja National Park, 4 km W. Santa Cecilia, Santa Rosa National Park, 5 km

NE. Quebrada Grande, Estacion Mengo [= Finca La Luz] on the upper slopes of Volcán Cacao and Casa Maritza on the lower slopes of Volcán Orosi in Guanacaste Province; Monteverde area in Puntarenas Province; Braulio Carrillo National Park, San Antonio de Escazú and San Isidro in San José Province.

Despite intensive collecting *E. flavoscutellatus* has never been collected on Barro Colorado Island in lowland wet forest. Neither has it been found to be present in similar habitats in Costa Rica (such as Tortuguero or Corcovado National Parks) though these last two sites are only poorly collected.

In lower montane humid forest sites such as Monteverde (1350 m) and Braulio Carrillo National Park (800 m) *E. flavoscutellatus* is present throughout the year, though in both sites it seems to be most abundant between January and April. It appears to be rather less common in Santa Rosa National Park where it has a different phenology. At this site virtually all specimens were collected from late May to July or from November to early January. These distributional peaks, which correspond to the beginning and end of the wet season, suggest this species may have two generations in deciduous forest. I have seen no specimens from Santa Rosa collected in February-April and only one in August to October.

I have dissected 10 females from Santa Rosa National Park and Monteverde. One had no eggs at all in either lateral oviduct; the remainder had between 9 and 17 eggs present (mean = 12.75) in each of the two lateral oviducts and the largest number of eggs found altogether in any one individual was 32. All eggs seemed to be mature and no small developing eggs were observed.

Despite the fact that this is an exceptionally common species at many sites, there is not a single host record available.

MATERIAL EXAMINED

Lectotype ♂ (*Enicospilus trispilus* Szépligeti), **Venezuela**: Merida (TM); paralectotypes: **Bolivia**: 1 ♀, Mapiri (TM); **Mexico**: 1 ♀, 'Verebelyi' (TM). Holotype ♀ (*Ophion flavo-scutellatus* Brullé), **Brazil**: Rio Grande (MNHN). Lectotype ♀ (*Ophion thoracicus* Cresson), **Cuba** '77.1' (PANS). Holotype ♂ (*Henicospilus attritus* Enderlein), **Peru**: Chanchamayo (IZPAN).

583 ♂, 649 ♀, from the following localities: **Argentina** (Buenos Aires, Misiones, Tucumán); **Barbados; Bolivia** (Chapare, Cochabamba, Ichilo, La Paz); **Brazil** (Bahia, Guanabara, Santa Catarina); **Colombia** (Antioquia, Cundinamarca, Huila, Magdalena, Valle); **Costa Rica** (Alajuela, Cartago, Guanacaste, Puntarenas, San José); **Cuba; Dominica; Dominican Republic; Ecuador** (Cotopaxi, Esmeraldas, Imbabura, Loja, Napo, Pichincha, Tungurahua, Zamora); **Grenada; Guadeloupe; Guatemala; Guyana; Jamaica; Martinique; Mexico** (Chiapas, Guerrero, Oaxaca, Tabasco); **Panama; Peru** (Cuzco, Huanuco, Lima, Loreto); **St Kitts; St Lucia; Surinam; Venezuela** (Caracas, Lara, Merida, Yaracuy). (BMNH, CNC, FSCA, PANS, TC, UMC, USNM.)

Enicospilus woldai sp. n.

(Fig. 327)

DESCRIPTION. Mandibles short, proximally strongly narrowed, with a small basal lobe, distally more weakly narrowed, apically twisted 80°; upper mandibular tooth slightly depressed, 1.4–1.5 times as long as the lower tooth; outer mandibular surface centrally convex, very sparsely pubescent, proximally with a narrow crescentic concavity. Labrum 0.3 times as long as broad; malar space 0.3–0.4 times as long as basal mandibular width. Clypeus in profile flat, margin sharp; clypeus in front view 1.3–1.4 times as broad as long, with margin truncate. Lower face 0.72–0.77 times as broad as long, centrally sparsely punctate. Head in dorsal view with genae rounded behind eyes; posterior ocellus close to eye; FI = 70–75%; occipital carina mediodorsally complete, ventrally curved to join hypostomal carina about 0.6–0.8 times the basal mandibular width away from mandible. Antenna slender, with 55–57 flagellar segments; 20th segment 2.0–2.2 times as long as broad.

Mesoscutum polished, finely and closely punctate, in profile abruptly rounded; notauli vestigial. Mesopleuron highly polished, the upper and lower parts punctate; epicnemial carina inclined towards anterior margin of pleuron, its upper end abruptly turned forward and evanescent. Scutellum in profile weakly convex, laterally carinate for 0.8 or more of its length; scutellum in dorsal view 1.5–1.6 times as long as anteriorly broad, anteriorly smooth and punctate, posteriorly longitudinally wrinkled. Metapleuron weakly convex, very finely coriaceous with weak punctures; submetapleural carina weakly broadened anteriorly; posterior transverse carina of mesosternum complete. Propodeum in profile evenly rounded; anterior transverse carina complete, posterior transverse carina absent; anterior area long, shallow, with irregular rugae; spiracular area quite long, smooth; posterior area finely wrinkled/rugulose, usually with a strong median longitudinal wrinkle; lateral longitudinal carina complete anteriorly, sometimes entire, not joined to spiracular margin by a short carina.

Fore wing length 15–16 mm; discosubmarginal cell as in Fig. 327; AI = 0.57–0.80; CI = 0.34–0.38; ICI = 0.42–0.47; SDI = 1.10–1.19; *cu-a* from subopposite to the base of *Rs&M* to proximal to it by 0.2 times its own length; marginal cell proximally uniformly hirsute; 1st subdiscal cell with anterior 0.4 very sparsely hirsute. Hind wing with 6–7 hamuli on *R*1; 1st abscissa of *Rs* almost straight, 2nd abscissa straight.

Fore leg with tibia slightly flattened, with fine, scattered spines on outer surface. Mid leg with longer tibial spur 1.3–1.5 times length of the shorter. Hind leg with coxa in profile 1.9–2.0 times as long as deep; trochantellus dorsally 0.5 times as long as broad; 4th segment of tarsus 2.3–2.4 times as long as broad; claws of female long, abruptly curved with short stout pectinae, those of male similar.

Gaster slender; tergite 2 in profile 4.9–5.5 times as long as posteriorly deep, laterotergite folded under, thyridia elongately oval and separated from anterior margin of tergite by about 4–5 times its own length. Ovipositor slender, its sheath narrow. Male with sternites 7–9 densely pubescent, bearing many long, erect hairs; subgenital plate unusual in having a small angular projection in the middle of the posterior margin; gonosquama large, distally rounded; aedeagus unusual in having a broad membranous collar proximal to apex.

Colour generally pale yellow; interocellar area yellow; antenna yellowish; pterostigma golden yellow; wings hyaline.

VARIATION. This is a morphologically very uniform species.

REMARKS. This species is named in honour of Dr Henk Wolda as a gesture of thanks for collecting virtually all the the ophionines known from Panama.

Enicospilus woldai is one of the most distinctive Central American species of *Enicospilus*. The large fenestra and trapezoidal proximal sclerite (Fig. 327) are quite unlike those of any other species. The highly modified male genitalia are similar to those of some species in the *trilineatus* species-group, but *E. woldai* does not have a pendant second epipleuron or the stout mandibles characteristic of taxa in this species-group.

BIOLOGICAL INFORMATION. *Enicospilus woldai* is only known to occur in lowland rainforest on Barro Colorado Island, Panama and in Ecuador. In Panama isolated individuals have been collected at light between the end of March and early August. The hosts of this species are unknown.

MATERIAL EXAMINED

Holotype ♀, **Panama**: Barro Colorado Island, 120 m, iv.1983 (*Wolda*) (BMNH)

Paratypes. **Ecuador**: 1 ♀, Pichincha Prov., Tinlandia, 12 km E. Santo Domingo de Los Colorados, 800 m, v.1986 (*Eger*) (BMNH). Panama: 1 ♀, Barro Colorado Island, Gatun Lake, iii.1979 (*Wolda*) (TC); 1 ♀, same locality, v.1982 (*Wolda*) (TC); Barro Colorado Island, 120 m, 1 ♀, v.1985; 1 ♂, vii.1984; 1 ♂, viii.1984; 2 ♀, v.1985 (*Wolda*) (BMNH).

***Enicospilus liesneri* sp. n.**

(Figs 128, 209, 328)

DESCRIPTION. Mandibles short, proximally strongly narrowed with a small proximoventral lobe, distally more evenly tapered, apically twisted 75–80°; upper mandibular tooth slightly depressed, 1.4–1.7 times as long as the lower tooth which is slightly compressed and unevenly tapered, with distal apex unusually slender; outer mandibular surface centrally flat, with scattered pubescence, proximally with a strong narrow concavity. Labrum 0.3–0.4 times as long as broad; malar space 0.1–0.2 times as long as basal mandibular width. Clypeus in profile flat, margin blunt to subacute; clypeus in front view 1.4–1.5 times as broad as long, with margin truncate or evenly slightly concave. Lower face 0.65–0.70 times as broad as long, convex, centrally punctate. Head in dorsal view with genae very short and strongly constricted (Fig. 128); posterior ocellus close to eye; FI = 65–70%; occiput unusually strongly impressed so that head is centrally very short, and abruptly declivous behind ocelli; occipital carina mediodorsally complete, ventrally curved to join hypostomal carina about 0.6–0.8 times the basal mandibular width away from mandible. Antenna long, but rather stout, with 47–50 flagellar segments; 20th segment 1.6–1.9 times as long as broad.

Mesoscutum polished, finely punctate, in profile abruptly rounded; notauli vestigial. Mesopleuron polished, the upper part sparsely finely punctate, the lower part slightly more closely punctate; epicnemial carina inclined towards anterior margin of pleuron, its upper end evanescent. Scutellum in profile weakly convex, laterally carinate for almost all of its length; scutellum in dorsal view 1.5–1.6 times as long as anteriorly broad, anteriorly smooth, posteriorly with isolated striae. Metapleuron flat except for a convex ridge dorsally, punctate; submetapleural carina evenly anteriorly broadened; posterior transverse carina of mesosternum broadly incomplete centrally. Propodeum in profile evenly declivous; anterior transverse carina generally complete, though often weak or evanescent laterally, posterior transverse carina absent; anterior area quite long, coriaceous with scattered longitudinal striae; spiracular area long, smooth;

posterior area weakly sculptured (Fig. 209), mainly coriaceous, but sometimes with a weak median longitudinal ridge; lateral longitudinal carina often complete, though sometimes weak posteriorly, indistinctly or not joined to spiracular margin by a short carina.

Fore wing length 11–14 mm; discosubmarginal cell as in Fig. 328; AI = 1.00–1.14; CI = 0.18–0.24; ICI = 0.45–0.54; SDI = 1.16–1.27; *cu-a* from subopposite to the base of *Rs&M* to proximal to it by 0.1 times its own length; marginal cell proximally broadly glabrous; 1st subdiscal cell with scattered pubescence over distal surface. Hind wing with 6–7 hamuli on *R*1; 1st abscissa of *Rs* straight, 2nd abscissa straight.

Fore leg with tibia weakly flattened, with isolated weak spines on outer surface. Mid leg with longer tibial spur 1.5–1.6 times length of the shorter. Hind leg with coxa in profile 1.7–1.8 times as long as deep; trochantellus dorsally 0.1 times as long as broad; 4th segment of tarsus 2.0–2.3 times as long as broad; claws of female rather small with fine close pectinae, those of male similar but with pectinae slightly shorter.

Gaster moderately slender; tergite 2 in profile 4.5–5.0 times as long as posteriorly deep, laterotergite folded under, thyridia elliptical and separated from anterior margin of tergite by about 2.5–3.0 times its own length. Ovipositor slender, its sheath narrow. Male with sternites 7–8 bearing lateromedian rows of long hairs which are sparse anteriorly and terminate in a large tuft posteriorly, tergite 9 with fine decumbent pubescence; gonosquama distally subacute.

Colour generally pale yellow, with three mesoscutal vittae and 5+ blackish; interocellar area yellow; antenna golden; pterostigma yellow; wings hyaline.

VARIATION. *Enicospilus liesneri* is a morphologically very uniform species. Some of the smaller individuals may have the mesoscutal vittae medium brown, or even paler, and a few have the posterior tergites of the gaster only very weakly infuscate.

REMARKS. This species is named in honour of Ron Liesner for his helpfulness in identifying Neotropical plants for biologists.

Enicospilus liesneri may easily be recognized by the shape of the head, which in dorsal view is extremely short centrally, and abruptly declivous behind the ocelli (Fig. 209). The antennae are much stouter than other small species with strongly twisted mandibles, and the arrangement of the pubescence on the male terminal sternites is quite characteristic. The characteristically modified form of the head of this species is also shared by *E. lovejoyi* which differs from *E. liesneri* most obviously in having a black interocellar area. The two are almost certainly sister-species, but their relationship to other taxa remains unclear. Possibly they are related to other species with a complete distal sclerite.

BIOLOGICAL INFORMATION. *Enicospilus liesneri* is a widely distributed species whose range extends from Veracruz in southern Mexico (*ca* 20°N) south to about 28°S in southern Brazil. It also has been recorded in Cuba, but it is not known to occur on any other Caribbean island. *E. liesneri* has been collected most frequently in the seasonally dry lowland forests of Guanacaste, Costa Rica, but it has been taken at altitudes up to 1350 m (e.g. at Monteverde), where it seems to be relatively rare.

In the seasonally dry forest in Santa Rosa National Park *E. liesneri* is one of the most frequently collected *Enicospilus* species at the beginning of the wet season. The cumulative light-trap data for the years 1980–87 are:

J	F	M	A	M	J	J	A	S	O	N	D
4	5	2	1	21	108	71	–	–	1	–	4

It has also beeen collected on San José Island, one of the small Murciélagos Islands off the coast of the Santa Elena Peninsula, in north-western Costa Rica.

E. liesneri is rather uncommon at light in wetter lowland forests such as on Barro Colorado Island, but even at this site it still seems to have a similar seasonal distribution. The cumulative data for Barro Colorado Island are:

J	F	M	A	M	J	J	A	S	O	N	D
2	1	1	6	4	2	5	–	–	–	–	–

Dr D. H. Janzen has reared *E. liesneri* on two occasions in Santa Rosa National Park from the larvae of a species of *Eulepidotis* (Noctuidae) found feeding on *Luehea* sp. (Tiliaceae) (rearing reference numbers 84-SRNP-473; 84-SRNP-547). The two parasitized caterpillars were collected on the 12th and 14th of June; they spun cocoons about four days later and the adult ichneumonids eclosed on the 1st and 3rd of July, suggesting this species may have more than one generation per year.

MATERIAL EXAMINED

Holotype ♀, **Costa Rica**: Guanacaste Prov., Santa Rosa National Park, 300 m, vi.1985 (*Gauld*) (BMNH).

Paratypes. **Brazil**: 2 ♀, Minas Gerais, Pedra Azul, 800 m, xi.1972 (*Alvarenga & Seabra*) (TC); 1 ♀, Minas Gerais, Aguas Vermelhas, 800 m, xii.1983 (*Alvarenga*) (TC); 1 ♂, Nova Teutonia, Santa Catarina, xi.1936 (*Plaumann*) (BMNH); 3 ♀, Pará, Tucuruf, i.1979 (*Alvarenga*) (TC). **Costa Rica**: Guanacaste Prov.: 1 ♀, Highway, 2 km E. Cuajiniquil, vi.1986 (*Gauld*) (BMNH); 6 ♂, 4 ♀, Islas Murciélagos, San José Is, viii.1987 (*Janzen & Hallwachs*) (BMNH); 97 ♂, 120 ♀, Santa Rosa National Park, 300 m, months as enumerated above, 1980–1986 (*Janzen & Hallwachs/Gauld*) (BMNH, CNC, MNCR, TC, USNM); 3 ♀, Volcán Cacao, Finca La Luz [= Estacion Mengo], 1100 m, viii.1986 (*Janzen & Hallwachs*) (BMNH); 8 ♀, same locality and collectors, vi-vii.1987 (BMNH); 3 ♀, Volcán Orosi, Casa Mariksa [= Maritza], 800 m, vii.1986 (*Gauld*) (BMNH): Puntarenas Prov.: 1 ♂, Monteverde, 1350 m, viii.1985 (*Haber*) (BMNH); 1 ♂, same locality and collector, vi.1986 (BMNH). **Cuba**: 5 ♂, Soledad, ii-iii.1925 (*Salt*) (MCZ); 3 ♂, 1 ♀, Soledad, ii-iii.1925 (*Salt*) (CNC). **Guatemala**: 1 ♂, 10 km W. Amatitlan, 1300 m, vi.1974 (*O'Brien*) (FSCA); 1 ♀, Cayuga, v.1915 (*Schaus*) (USNM). **Honduras**: 1 ♀, Lancetilla (*Bates*) (MCZ). **Mexico**: Chiapas: 1 ♂, 32 km N. Huixtla, 1000 m, vi.1969 (*Mason*) (CNC): Veracruz: 2 ♀, Lake Catemaco, Coyame, viii.1963 (*Woodruff*) (FSCA). **Panama**: 1 ♂, 1 ♀, Barro Colorado Island, vi.1978 (*Wolda*) (RNH); Barro Colorado Island, Gatun Lake, 1 ♀, ii.1979; 5 ♀, iv.1979; 1 ♂, i.1983; 1 ♂, iii.1983 (*Wolda*) (TC); 2 ♂, 9 ♀, same locality, 120 m, i-vii.1983–4 (*Wolda*) (BMNH). **Venezuela**: 1 ♀, Junquito, viii.1940 (TC).

Enicospilus marini sp. n.

(Fig. 329)

DESCRIPTION. Mandibles short, proximally strongly narrowed, with a small proximoventral lobe, distally more evenly narrowed, apically twisted 75–80°; upper mandibular tooth slightly depressed, 1.4–1.7 times as long as the lower tooth which is compressed and apically very acute; outer mandibular surface with a strong proximal concavity, distally convex with scattered pubescence. Labrum 0.2–0.3 times as long as broad; malar space 0.1–0.2 times as long as basal mandibular width. Clypeus in profile from almost flat to very weakly convex, margin blunt; clypeus in front view 1.2–1.4 times as broad as long, the margin truncate apically. Lower face 0.66–0.70 times as broad as long, convex, centrally finely punctate. Head in dorsal view with genae constricted behind eyes; posterior ocellus close to eye; FI = 60–65%; occipital carina mediodorsally complete, ventrally curved to join hypostomal carina about 0.6–0.8 times the basal mandibular width away from mandible, but with lower end very weak. Antenna long and slender, with 50–52 flagellar segments; 20th segment 2.2–2.3 times as long as broad.

Mesoscutum polished, sparsely punctate, in profile abruptly rounded with anterior margin out-turned; notauli vestigial. Mesopleuron polished, the upper part punctate to punctostriate, the lower part punctostriate to striate; epicnemial carina curved towards anterior margin of pleuron, with upper end evanescent. Scutellum in profile weakly convex, laterally carinate for almost all of its length; scutellum in dorsal view 1.5–1.6 times as long as anteriorly broad, smooth, with isolated rugae posteriorly. Metapleuron weakly convex, from punctate with scattered weak striae to diagonally striate; submetapleural carina evenly anteriorly broadened; posterior transverse carina of mesosternum centrally interrupted. Propodeum in profile abruptly declivous; anterior transverse carina complete, laterally sometimes weak, posterior transverse carina absent; anterior area short, with isolated rugae; spiracular area long, smooth; posterior area rugose, often with a median longitudinal ridge and with almost concentric transverse rugae, but in some specimens with this sculpture weakly developed; lateral longitudinal carina generally complete, not joined to spiracular margin by a distinct short carina.

Fore wing length 10–11 mm; discosubmarginal cell as in Fig. 329; AI = 1.00–1.68; CI = 0.19–0.27; ICI = 0.36–0.41; SDI = 1.14–1.51; *cu-a* opposite to the base of *Rs&M*; marginal cell proximally broadly glabrous; 1st subdiscal cell with scattered hairs. Hind wing with 5–6 hamuli on *R*1; 1st abscissa of *Rs* straight, 2nd abscissa almost straight.

Fore leg with tibia weakly flattened, with scattered spines on outer surface. Mid leg with longer tibial spur 1.5–1.7 times length of the shorter. Hind leg with coxa in profile 1.7–1.9 times as long as deep; trochantellus dorsally 0.1 times as long as broad; 4th segment of tarsus 3.0–3.1 times as long as broad; claws of female quite long, with short pectinae, those of male similar, but with pectinae finer.

Gaster slender; tergite 2 in profile 5.5–6.1 times as long as posteriorly deep, laterotergite folded under, thyridia elliptical and separated from anterior margin of tergite by about 3.5–4.0 times its own length. Ovipositor apically quite slender, its sheath narrow. Male with sternites 7–9 bearing numerous long, slightly curved, erect hairs; gonosquama apically rounded.

Colour generally pale yellowish brown, with head, pro- and mesothorax paler yellow; mesoscutum with three blackish longitudinal stripes; alitrunk laterally with a crescentic dark mark near the upper hind corner of the mesopleuron, and with an indistinct dark patch between the propodeum and the metapleuron; gaster with tergites 5+ infuscate; interocellar area yellow, blackish between the posterior ocelli; antenna yellowish brown; pterostigma yellowish brown; wings more or less hyaline.

Variation. Some of the Brazilian specimens examined are paler yellowish with tergites 2+ of the gaster infuscate. This specimens often, but not always, have the meso- and metapleurae almost smooth, and highly polished.

Remarks. This species is named in honour of Sigifredo Marín for his great efforts to promote positive interactions between Costa Rican National Parks and their neighbours.

Enicospilus marini is a small species that is most easily recognized by the form of the proximal sclerite (Fig. 329); a similar one is not found in any other Central American species. *E. marini* is one of a group of about six rather similar small species (herein called the *marini* species-complex) that are widely distributed throughout tropical America. Some have only been collected in Brazil, but three others *E. oduberi*, *E. pescadori* and *E. sanchezi*, occur in Central America. All these species are characterized by being small, having similar pleural and propodeal scuplture, and by having similar venation. All usually also have a crescent-shaped dark mark on the mesopleuron.

Biological Information. *Enicospilus marini* is a widely distributed species whose range extends from El Salvador (*ca* 16°N), south to central Brazil (14°S). The majority of specimens are labelled as having been collected below 1000 m and none has been labelled as being from above this altitude (some have no altitude appended). In the seasonally dry forests of Santa Rosa National Park *E. marini* has been collected intermittently between April and December with most at the end of the dry season (April/May). The pooled data for all captures at this site are:

J	F	M	A	M	J	J	A	S	O	N	D
–	–	–	5	1	–	1	–	–	1	–	1

Despite intensive light-trapping in lowland rainforest on Barro Colorado Island *E. marini* has only been collected on two occasions, in January and June.

The hosts of this species are unknown.

Material Examined

Holotype ♀, **Costa Rica**: Guanacaste Prov., 300 m, iv.1983 (*Janzen & Hallwachs*) (BMNH).

Paratypes. **Brazil**: 6 ♀, Bahia, Encruzilhada, 960 m, xi.1972 (*Alvarenga*) (TC); 4 ♀, same locality and collector, 980 m, xi.1973, xi.1974 (TC); 1 ♀, Minas Gerais, Aguas Vermelhas, 800 m, xii.1983 (*Alvarenga*) (TC). **Costa Rica**: Guanacaste Prov.: 1 ♀, Santa Rosa National Park, 300 m, xii.1976 (*Janzen*) (TC); same locality and collector, 1 ♀, x.1977 (TC); 1 ♀, vii.1978 (BMNH); 1 ♀, same locality, v.1980 (*Janzen & Hallwachs*) (TC); same locality and collectors, 3 ♀, iv.1983 (BMNH); 1 ♀, iv.1984 (BMNH). **El Salvador**: 1 ♂, Lake Coatapeque, viii.1972 (*Hevel*) (USNM). **Panama**: 2 ♀, Barro Colorado Island, 120 m, vi.1983, i.1984 (*Wolda*) (BMNH). **Venezuela**: 1 ♀, Aragua, Portachuelo Pass, nr Rancho Grande, iv.1960 (*Test*) (UMC).

Enicospilus sanchezi sp. n.

(Figs 125, 127, 330)

Description. Mandibles quite short, distally evenly narrowed, apically twisted about 70°; upper mandibular tooth strongly depressed, 1.2–1.3 times as long as the laterally compressed lower tooth; outer mandibular surface sparsely pubescent, flat with a broad shallow proximal concavity. Labrum 0.2–0.3 times as long as broad; malar space 0.4 times as long as basal mandibular width. Clypeus in profile very weakly convex, margin flat; clypeus in front view 1.4–1.5 times as broad as long, the apical margin truncate. Lower face 0.70–0.75 times as broad as long, centrally polished, finely punctate. Head in dorsal view with genae constricted behind the eyes; posterior ocellus contiguous with the eye; FI = 60–65%; occipital carina mediodorsally complete, ventrally curved to join hypostomal carina about 0.7–0.8 times the basal mandibular width away from mandible. Antenna long and slender, with 47–52 flagellar segments; 20th segment 2.4–2.7 times as long as broad.

Mesoscutum polished, sparsely punctate, in profile abruptly rounded; notauli absent. Mesopleuron polished, the upper part punctate, the lower part punctostriate; epicnemial carina strong, inclined towards anterior margin of pleuron. Scutellum in profile weakly convex, laterally carinate for 0.9 or more of its length; scutellum in dorsal view 1.5–1.6 times as long as anteriorly broad, polished with scattered punctures, with a few longitudinal striae posteriorly. Metapleuron weakly convex, punctate to punctostriate; submetapleural carina evenly anteriorly broadened; posterior transverse carina of mesosternum complete, strong centrally. Propodeum in profile evenly declivous; anterior transverse carina complete, posterior transverse carina absent; anterior area short, steep, bearing isolated striae; spiracular area long, smooth; posterior area with distinct irregular wrinkles; lateral longitudinal carina complete or evanescent posteriorly, joined to spiracular margin by a short carina.

Fore wing length 7–11 mm; discosubmarginal cell as in Fig. 330; AI = 1.00–1.50; CI = 0.25–0.43; ICI = 0.25–0.37; SDI = 1.07–1.24; *cu-a* more or less opposite to the base of *Rs&M*; marginal cell proximally narrowly glabrous close to *Rs+2r*; 1st subdiscal cell with centre hirsute, this hirsute area reaching to distal end, the anterior and posterior margins very sparsely hirsute; unusual in having 2nd discal cell posteriorly glabrous, and with a glabrous arc in 2nd subdiscal cell. Hind wing with 5–6 hamuli on *R*1; 1st abscissa of *Rs* weakly but distinctly bowed centrally (Fig. 127), 2nd abscissa almost straight.

Fore leg with tibia barely flattened, with isolate fine spines on outer surface. Mid leg with longer tibial spur 1.5–1.6 times length of the shorter. Hind leg with coxa in profile 1.6–1.7 times as long as deep; trochantellus dorsally about 0.3 times as long as broad; 4th segment of tarsus 2.6–2.8 times as long as broad; claws of female evenly curved, with close long stout pectinae, those of male similar.

Gaster long and slender; tergite 2 in profile more than 7 times as long as posteriorly deep, laterotergite very narrow, membranous, pendant, thyridia elliptical and separated from anterior margin of tergite by about 3 times its own length. Ovipositor moderately stout, straight, its sheath narrow. Male with sternites 7–9 bearing long, rather sparse, slightly curved, erect hairs; gonosquama apically rounded.

Colour generally pale yellowish with slightly darker mesoscutal vittae and with the posterior part of the mesoscutum infuscate; upper part of mesopleuron with a large dark mark posteriorly, that extends down pleural suture beyond level of episternal scrobe, and with its lower anterior end extending forward to or almost to epicnemial carina (Fig. 125); anterior concavity of metapleuron frequently with an infuscate mark; gaster yellowish, at the most with a general slight darkening posteriorly; interocellar area yellowish, or slightly infuscate between posterior ocelli, and often with frons below median ocellus infuscate; antenna yellowish, slightly infuscate distally; pterostigma yellow; wings hyaline.

Variation. One female from Santa Rosa is slightly 'gummy' but appears to have the laterotergites turned under. In other characters it is a typical member of this species, but I have excluded it from the paratype series. The Venezuelan specimen has dark mesoscutal vittae.

Remarks. This species is named in honour of Pablo Sanchez in recognition of his administrative efforts at the Museo Nacional de Costa Rica.

Enicospilus sanchezi is very similar to *E. pescadori* but, with the exception of the single specimen referred to above, the characters given in the key work well for the material at hand. The pubescence of the 2nd discal and 2nd subdiscal cells of the fore wing is rather more uniform in *E. pescadori* than it is in *E. sanchezi* (cf. Figs 330 and 331). *E. sanchezi* belongs to the *E. marini* species-complex.

Biological Information. *Enicospilus sanchezi* is a widely distributed tropical American species whose range extends from the extreme south of Mexico (about 15°N) south to Venezuela. Isolated specimens have been collected in Santa Rosa National Park between April and November. The seasonal distribution for cumulative catch in Santa Rosa (1977–86) is:

J	F	M	A	M	J	J	A	S	O	N	D
–	–	–	1	2	1	3	1	–	–	1	–

Nothing is known about the biology of this species.

Material Examined

Holotype ♀, **Costa Rica**: Guanacaste Prov., Santa Rosa National Park, 300 m, v.1986 (*Gauld*) (BMNH).

Paratypes. **Costa Rica**: Guanacaste Prov.: 4 ♀, Santa Rosa National Park, 300 m, vii-viii, xi.1977 (*Janzen*) (TC); 1 ♀, same locality, iv.1983 (*Janzen & Hallwachs*) (BMNH); 3 ♀, same locality, vi.1985, v & vii.1986 (*Gauld*) (BMNH); 1 ♂, Volcán Orosi, Casa Mariksa [= Maritza], 550 m, i.1986 (*Janzen & Hallwachs*) (BMNH). **Mexico**: Chiapas: 1 ♂, 32 km N. Huixtla, 1000 m, vi.1969 (*Mason*) (CNC); 1 ♂, 3 ♀, Muste, nr Huixtla, 440 m, ix.1970 (*Welling*) (CNC). **Panama**: 1 ♀, Canal Zone, Margarita, v.1960 (*Breeland*) (TC). **Venezuela**: 1 ♀, Rancho Grande, ii.1970 (*Howden*) (TC).

Non-paratypic material. **Costa Rica**: 1 ♀, Guanacaste Prov., Santa Rosa National Park, vi.1980 (*Janzen & Hallwachs*) (BMNH).

Enicospilus pescadori sp. n.

(Figs 124, 126, 331)

Description. Mandibles quite short, distally evenly narrowed, apically twisted about 70°; upper mandibular tooth strongly depressed, 1.3–1.5 times as long as the laterally compressed lower tooth; outer mandibular surface sparsely pubescent, flat with a broad shallow proximal concavity. Labrum 0.2–0.3 times as long as broad; malar space 0.4 times as long as basal mandibular width. Clypeus in profile very weakly convex, margin flat; clypeus in front view 1.4–1.5 times as broad as long, the apical margin truncate. Lower face 0.65–0.70 times as broad as long, centrally polished, finely punctate. Head in dorsal view with genae constricted behind the eyes; posterior ocellus contiguous with the eye; FI = 60–65%; occipital carina mediodorsally complete, ventrally curved to join hypostomal carina about 0.6–0.8 times the basal mandibular width away from mandible. Antenna long and slender, with 48–52 flagellar segments; 20th segment 2.0–2.4 times as long as broad.

Mesoscutum polished, sparsely punctate, in profile abruptly rounded; notauli absent. Mesopleuron polished, the upper part punctate, the lower part punctostriate; epicnemial carina strong, inclined towards anterior margin of pleuron. Scutellum in profile weakly convex, laterally carinate for 0.9 or more of its length; scutellum in dorsal view 1.5–1.6 times as long as anteriorly broad, polished with scattered punctures, with a few longitudinal striae posteriorly. Metapleuron weakly convex, punctate to punctostriate; submetapleural carina evenly anteriorly broadened; posterior transverse carina of mesosternum complete, strong centrally. Propodeum in profile evenly declivous; anterior transverse carina complete, posterior transverse carina absent; anterior area short, steep, bearing isolated striae; spiracular area long, smooth; posterior area with distinct irregular wrinkles; lateral longitudinal carina complete or evanescent posteriorly, joined to spiracular margin by a short carina.

Fore wing length 10–12 mm; discosubmarginal cell as in Fig. 331; AI = 0.95–1.25; CI = 0.16–0.21; ICI = 0.30–0.35; SDI = 1.05–1.27; *cu-a* more or less opposite to the base of *Rs&M*; marginal cell proximally narrowly glabrous close to *Rs+2r*; 1st subdiscal cell with distal part sparsely hirsute. Hind wing with 5–6 hamuli on *R*1; 1st abscissa of *Rs* straight (Fig. 126), 2nd abscissa more or less straight.

Fore leg with tibia subcylindrical; with isolated spines on outer surface. Mid leg with longer tibial spur 1.5–1.6 times length of the shorter. Hind leg with coxa in profile 1.6–1.7 times as long as deep; trochantellus dorsally <0.1 times as long as broad; 4th segment of tarsus 2.2–2.4 times as long as broad; claws of female moderately long, evenly curved, with close fine pectinae; claws of male shorter and more abruptly rounded, with slender pectinae.

Gaster long and slender; tergite 2 in profile more than 6 times as long as posteriorly deep, laterotergite folded under, thyridia elliptical and separated from anterior margin of tergite by about 3 times its own length. Ovipositor slender, straight, its sheath narrow. Male with sternites 7–9 bearing close erect pubescence; gonosquama apically rounded.

Colour generally bright yellowish, with three longitudinal dark vittae on the mesoscutum; mesopleuron bearing a small infuscate mark that extends from upper hind corner to near episternal scrobe, but does not extend down margin of pleural suture (Fig. 124); gaster yellow with posterior part of tergite 5 and the following tergites infuscate; interocellar area yellow; antenna golden; pterostigma yellowish; wings hyaline.

Variation. The specimen from Brazil has the meso- and metapleurae smoother than those of other specimens.

Remarks. This species is named in honour of Alfonso Pescador for his studies of the moth fauna of the Chamela Biological Station, Mexico.

Enicospilus pescadori is morphologically very similar to *E. sanchezi*, but the two species differ consistently in a number of quite subtle features. Most obviously they differ in colour: *E. pescadori* has a much less extensively dark-marked mesopleuron than *E. sanchezi*, never has dark metapleural marks and has the posterior half of tergite 5 and tergites 6+ infuscate, contrasting with the generally pale yellow gaster. The gaster of *E. sanchezi* is uniformly yellowish with, at most, an indistinct infuscation on tergites 3+. Most specimens of *E. sanchezi* have only the posterior half of the mesoscutum dark-marked, whilst the mesoscutal vittae of *E. pescadori* are blackish. Correlating with these colour differences are some structural differences. These are tabulated below.

	pescadori	*sanchezi*
value of CI	0.16–0.21	0.25–0.43
length of 20th flagellar segment to its width	2.0–2.4	2.4–2.7
laterotergite 2	upturned	pendant
1st abscissa of *Rs* in hind wing	straight	bowed
distal sclerite near proximal sclerite	strong	weak

Enicospilus pescadori belongs to the *E. marini* species-complex (see that species).

BIOLOGICAL INFORMATION. The range of this species extends from northern Costa Rica (11°N) south to Bahia, Brazil (13°S). In Costa Rica it has only been collected in the seasonally dry forest in Santa Rosa National Park where isolated individuals have occasionally been taken between April and December. A single female has been reared from a larva which might be a species of *Eulepidotis* (Noctuidae) (rearing reference number: 82-SRNP-344A).

MATERIAL EXAMINED

Holotype ♀, **Costa Rica**: Guanacaste Prov., Santa Rosa National Park, 300 m, vii.1982 (*Janzen & Hallwachs*) (BMNH).

Paratypes. **Brazil**: 1 ♀, Bahia, Encruzilhada, 960 m, xi.1972 (*Alvarenga*) (TC). **Costa Rica**: Guanacaste Prov.: 4 ♀, Santa Rosa National Park, dry hill, vi, viii, x, xi.1977 (*Janzen*) (TC); 1 ♀, Santa Rosa National Park, 300 m, xii.1982 (*Janzen & Hallwachs*) (BMNH); 1 ♂, 1 ♀, same locality and collectors, iv, v.1983 (BMNH).

***Enicospilus howdenorum* sp. n.**

(Figs 142, 145, 211, 332)

DESCRIPTION. Mandibles long, proximally strongly narrowed, distally parallel-sided, apically twisted 15–25°; upper mandibular tooth cylindrical, 1.6–1.8 times as long as the lower tooth; outer mandibular surface very slightly concave, the concave area weakly coriaceous and bearing long fine pubescence; proximal concavity weak. Labrum 0.2–0.3 times as long as broad; malar space 0.3–0.4 times as long as basal mandibular width. Clypeus in profile moderately convex, margin impressed, acute; clypeus in front view 1.4–1.5 times as broad as long, with margin weakly convex apically. Lower face 0.68–0.73 times as broad as long, centrally polished, finely punctate. Head in dorsal view with genae rounded behind eye; posterior ocellus close to eye; FI = 70–75%; occipital carina mediodorsally complete, ventrally curved to join hypostomal carina about 0.8 times the basal mandibular width away from mandible. Antenna long and slender, with 64–66 flagellar segments; 20th segment 2.1–2.4 times as long as broad.

Mesoscutum polished, finely and inconspicuously punctate, in profile evenly rounded; notauli vestigial. Mesopleuron polished, more or less evenly finely punctate; epicnemial carina inclined towards anterior margin of pleuron, its upper end often weak or obsolescent. Scutellum in profile moderately convex, laterally carinate for 0.9 or more of its length; scutellum in dorsal view 1.6–1.7 times as long as anteriorly broad, finely punctate, with isolated striae posteriorly. Metapleuron strongly convex, polished and finely punctate (Fig. 211); submetapleural carina evenly anteriorly broadened; posterior transverse carina of mesosternum complete. Propodeum in profile evenly rounded (Fig. 145); anterior transverse carina complete or evanescent at lateral extremities, posterior transverse carina absent; anterior area steep, striate; spiracular area moderately long, smooth; posterior area closely irregularly reticulate, becoming almost longitudinally striate close to anterior transverse carina; lateral longitudinal carina usually complete, joined to spiracular margin by a short carina.

Fore wing length 12–14 mm; discosubmarginal cell as in Fig. 332; AI = 0.65–0.75; CI = 0.28–0.45; ICI = 0.37–0.45; SDI = 1.10–1.19; *cu-a* subopposite to the base of *Rs&M*, at the most proximal to it by about its own thickness; marginal cell proximally uniformly hirsute; 1st subdiscal cell with central and distal parts sparsely hirsute. Hind wing with 7–8 hamuli on *R*1; 1st abscissa of *Rs* straight, 2nd abscissa bowed; first abscissa of *Cu*1 unusual in that it is bowed, and joining *cu-a* at an angle of less than 90°; *cu-a* unusually long, 0.4–0.5 times the length of the first abscissa of *Cu*1 (Fig. 142).

Fore leg with tibia distinctly flattened, with either very few, or without obvious spines on outer surface. Mid leg with longer tibial spur 1.4–1.5 times length of the shorter. Hind leg with coxa in profile 1.9–2.0 times as long as deep; trochantellus dorsally 0.1 times as long as broad; 4th segment of tarsus 2.3–2.5 times as long as broad; claws of female moderately long, evenly curved, with close short pectinae, those of male similar.

Gaster long and slender; tergite 2 in profile more than 6 times as long as posteriorly deep, laterotergite folded under, thyridia elliptical and separated from anterior margin of tergite by about 2.5–3.5 times its own length. Ovipositor slender, its sheath narrow. Male with sternites 7–9 bearing fine semidecumbent pubescence; gonosquama apically evenly rounded.

Colour generally from pale brownish yellow to medium yellowish brown, with central lobe of mesoscutum weakly infuscate and with gaster indistinctly infuscate posteriorly; interocellar area yellowish; antenna yellowish brown; pterostigma from yellowish brown to quite dark brown; wings hyaline.

VARIATION. The Cuban specimen is paler yellow in colour than the others.

REMARKS. This species is named in honour of Henry and Anne Howden in recognition of their collecting efforts in Central America.

Enicospilus howdenorum and *E. sondrae* form a distinctive sister-species pair. They are characterized by having *cu-a* in the hind wing 0.4–0.5 times as long as a bowed first abscissa of *Cu*1 (Fig. 142). In most other species this abscissa of *Cu*1 is straight, and almost invariably *cu-a* is much less than 0.25 times its length. Both *E. howdenorum* and *E. sondrae* have somewhat similar central sclerites, lack any trace of a distal sclerite and have *cu-a* in the fore wing virtually opposite the base of *Rs&M*. The two species may easily be separated by the characters given in the key (see also p. 284).

E. howdenorum is only known to occur on the older larger Caribbean islands of Cuba, Hispaniola and Jamaica and its sister-species *E. sondrae* has a similar but slightly more extensive distribution (it occurs in Florida and may also occur on Dominica). This suggests that this species-complex may have arisen on the old Caribbean islands.

BIOLOGICAL INFORMATION. *Enicospilus howdenorum* is only recorded from Cuba, Jamaica and Hispaniola where it has been collected at altitudes between 1050 and 1350 m. Nothing is otherwise known of its habitat preferences or its hosts.

MATERIAL EXAMINED

Holotype ♀, **Jamaica**: Hardwar Gap, 1300 m, vii.1966 (*Howden & Becker*) (CNC).

Paratypes. **Cuba**: 1 ♀, Sierra Maestra, 1050–1350 m, vii.1922 (*Ballou & Bruner*) (USNM). **Haiti**: 1 ♀, Desbarrière, La Hotte, 1300 m, x.1934 (*Darlington*) (MCZ). **Jamaica**: 3 ♂, 1 ♀, Hardwar Gap, 1300 m, vii.1966 (*Howden & Becker*) (BMNH, CNC).

Enicospilus sondrae sp. n.

(Figs 146, 333)

DESCRIPTION. Mandibles moderately long, proximally strongly narrowed, distally weakly narrowed, apically twisted 30–40°; upper mandibular tooth quite slender, subcylindrical, 1.5–1.7 times as long as the lower tooth; outer mandibular surface sparsely pubescent, distally flat, proximally with a shallow weak concavity. Labrum 0.2 times as long as broad; malar space 0.3 times as long as basal mandibular width. Clypeus in profile weakly convex, margin blunt; clypeus in front view 1.3–1.4 times as broad as long, with margin subtruncate apically. Lower face 0.74–0.76 times as broad as long, weakly polished, finely punctate with a little wrinkling centrally. Head in dorsal view with genae constricted behind eyes; posterior ocellus close to eye; FI = 70–75%; occipital carina mediodorsally complete, ventrally curved to join hypostomal carina about 0.8 times the basal mandibular width away from mandible. Antenna long and slender, with 50–57 flagellar segments; 20th segment 1.7–2.1 times as long as broad.

Mesoscutum weakly polished, finely punctate, in profile evenly rounded; notauli vestigial. Mesopleuron polished, the upper part punctate to punctostriate, the lower part punctostriate to striate; epicnemial carina inclined towards anterior margin of pleuron, with upper end evanescent. Scutellum in profile moderately convex, laterally carinate for 0.8 or more of its length; scutellum in dorsal view 1.5–1.6 times as long as anteriorly broad, smooth anteriorly, posteriorly with fine longitudinal striae. Metapleuron convex, punctate with diagonal rugae at least present posterodorsally (Fig. 146); submetapleural carina evenly anteriorly broadened; posterior transverse carina of mesosternum complete. Propodeum in profile evenly declivous; anterior transverse carina more or less complete, posterior transverse carina absent; anterior area steep, striate; spiracular area moderately long, finely punctate; posterior area irregularly rugose-coriaceous, usually with a median longitudinal wrinkle; lateral longitudinal carina weak but more or less complete, joined to spiracular margin by a short carina.

Fore wing length 15–17 mm; discosubmarginal cell as in Fig. 333; AI = 1.00–1.38; CI = 0.31–0.40; ICI = 0.38–0.54; SDI = 1.10–1.25; *cu-a* subopposite to the base of *Rs&M*; marginal cell proximally very sparsely hirsute; 1st subdiscal cell with isolated hairs anterodistally. Hind wing with 5–7 hamuli on *R*1; 1st abscissa of *Rs* straight, 2nd abscissa almost straight; *cu-a* unusual in being 0.4–0.5 times as long as the bowed first abscissa of *Cu*1.

Fore leg with tibia flattened, with scattered spines on outer surface. Mid leg with longer tibial spur 1.5–1.7 times length of the shorter. Hind leg with coxa in profile 1.7–1.8 times as long as deep; trochantellus dorsally <0.1 times as long as broad; 4th segment of tarsus 1.7–1.8 times as long as broad; claws of female long, distally very abruptly curved through about 100°, with close short pectinae; claws of male similar.

Gaster long and slender; tergite 2 in profile 5.0–6.0 times as long as posteriorly deep, laterotergite folded under, thyridia elliptical and separated from anterior margin of tergite by about 4–5 times its own length. Ovipositor straight, its sheath narrow. Male with sternites 7–9 bearing highly modified pubescence – sternite 7 centrally glabrous with lateral longitudinal rows of long erect hairs, sternite 8 more or less entirely glabrous (partly obscured in material at hand so I could not see if the hair rows are present anteriorly), and sternite 9 with short fine decumbent pubescence; gonosquama quite short, apically rounded.

Colour generally yellowish brown, head and scutellum bright yellow, mesoscutum with dark longitudinal vittae; interocellar area yellow; antenna golden; pterostigma golden; wings hyaline.

VARIATION. The female from 'Dominica' has the metapleuron regularly punctate, without the rugae that characterize the other specimens.

REMARKS. This species is dedicated to Sondra Ward in appreciation for her great help in preparing this manuscript.

Enicospilus sondrae is closely related to *E. howdenorum* (see that species) and is most easily recognized by the centrally incrassate *Rs+2r* and the proximally sparsely hirsute marginal cell.

The males of *E. sondrae* differ strikingly from those of *E. howdenorum* in the distribution of the hairs on the terminal sternites. In particular, *E. howdenorum* has scattered fine semidecumbent hairs present on sternite 7, whilst *E. sondrae* has long erect hairs arranged in rows, and the sternite is glabrous centrally. A similar hair pattern occurs in *E. lacsa* and *E. echeverri*, and possibly these two taxa may be related to *E. sondrae*. The distribution of these characters presents a considerable classificatory problem, and amply demonstrates the difficulties one has trying to group species of *Enicospilus*. *E. howdenorum* and *E. sondrae* share several striking autapomorphic features (hind wing venation; alar sclerites) which are not shared by *E. lacsa* and *E. echeverri*. However, *E. sondrae*, *E. lacsa* and *E. echeverri* all have males with very similar and highly specialized hair patterns on sternites 7–9 (see Fig. 200). These two suites of characters are incompatible; either *E. sondrae* evolved the hair pattern independently from the other two species, or *E. howdenorum* and *E. sondrae* evolved very similar fore and hind wings independently. The distribution of these species suggests the former, but clearly more evidence of relationship is required.

BIOLOGICAL INFORMATION. *Enicospilus sondrae* is only known to occur on some Caribbean Islands and on the Florida Keys. A single damaged female in the BMNH is labelled as having been collected in 'Dominica'. Whether this refers to the island of Dominica between Guadeloupe and Martinique in the Lesser Antilles, or to the Dominican Republic in eastern Hispaniola is uncertain. Nothing is known of the habitat preferences or host range of this species.

MATERIAL EXAMINED

Holotype ♀, **U.S.A.**: Florida, Paradise Key, iv.1951 (*Townes & Townes*) (TC).

Paratypes. **Dominica**: 1 ♀, no further locality data, 1901 (*Nicholls*) (BMNH). **Dominican Republic**: 1 ♀, Dajabon Prov., 13 km S. Loma de Cabrera, 400 m, v.1973 (*Davis & Davis*) (USNM). **Jamaica**: 1 ♀, Trelawney, Good Hope, vii.1966 (*Howden*) (CNC). U.S.A.: Florida: 2 ♀, 1 ♂, Paradise Key, iv.1951 (*Townes & Townes*) (TC).

Enicospilus oduberi sp. n.

(Figs 123, 334)

DESCRIPTION. Mandibles quite short, rather evenly tapered, but with a distinct proximoventral lobe, the apex of the mandible twisted about 30°; upper mandibular tooth very slender, depressed, about 1.8 times as long as the lower tooth; outer mandibular surface finely and sparsely pubescent, centrally slightly concave, and with a small deeper concavity on proximoventral lobe. Labrum 0.3 times as long as broad; malar space 0.3 times as long as basal mandibular width. Clypeus in profile weakly convex, margin flat, slightly blunt;

clypeus in front view 1.3–1.4 times as broad as long, with margin subtruncate apically. Lower face 0.62–0.63 times as broad as long, centrally polished, with indistinct punctures. Head in dorsal view with genae constricted behind eye; posterior ocellus very close to eye; FI = 68–72%; occipital carina mediodorsally complete, ventrally angled to join hypostomal carina about 0.8–0.9 times the basal mandibular width away from mandible. Antenna very long and slender, with 58–60 flagellar segments; 20th flagellar segment 3.1–3.2 times as long as broad.

Mesoscutum polished with isolated inconspicuous punctures, in profile abruptly rounded; notauli absent. Mesopleuron polished, the upper part with isolated punctures, the lower part similar, but with a little irregular wrinkling also; epicnemial carina inclined towards anterior margin of pleuron. Scutellum in profile moderately convex, laterally carinate for all of its length; scutellum in dorsal view 1.5 times as long as anteriorly broad, smooth with isolated wrinkles posteriorly. Metapleuron weakly convex, with close fine punctures; submetapleural carina fairly evenly anteriorly broadened; posterior transverse carina of mesosternum complete. Propodeum in profile evenly declivous; anterior transverse carina complete, posterior transverse carina absent; anterior area short, steep, rugose-striate; spiracular area long, smooth; posterior area with weak transverse rugae which are more irregular and difficult to discern near transverse carina; lateral longitudinal carina complete, joined to spiracular margin by a short carina.

Fore wing length 10–11 mm; discosubmarginal cell as in Fig. 334; AI = 1.32–1.63; CI = 0.25–0.27; ICI = 0.35–0.39; SDI = 1.15–1.22; *cu-a* from subopposite to distal to the base of *Rs&M* from by about its own thickness to by 0.1 times its own length; marginal cell proximally broadly glabrous; 1st subdiscal cell fairly evenly hirsute except for proximal end which is glabrous. Hind wing with 4 hamuli on *R*1; 1st abscissa of *Rs* very slightly curved, 2nd abscissa distinctly arcuate.

Fore leg with tibia subcylindrical, with scattered spines on outer surface. Mid leg with longer tibial spur 1.7–2.0 times length of the shorter. Hind leg with coxa in profile 1.9 times as long as deep; trochantellus dorsally 0.2 times as long as broad; 4th segment of tarsus 2.1–2.2 times as long as broad; claws of female long, apically evenly curved, with quite short, widely spaced pectinae.

Gaster slender; tergite 2 in profile 6–7 times as long as posteriorly deep, laterotergite folded under, thyridia elliptical and separated from anterior margin of tergite by about 4.5–5.0 times its own length. Ovipositor apically slender, slightly decurved, its sheath narrow. Male unknown.

Colour generally dirty yellow, with area between antennal bases, mesoscutal vittae, posterior margin of mesopleuron from upper corner to below level of episternal scrobe (Fig. 123), and anterior part of metapleuron dark-marked; gaster yellowish with tergites 4+ weakly infuscate; interocellar area yellowish, but infuscate between posterior ocelli; antenna golden, slightly infuscate apically; pterostigma yellow; wings hyaline.

VARIATION. None remarkable.

REMARKS. This species is named in honour of Daniel Oduber, in recognition of his efforts to establish the national parks of Costa Rica.

Enicospilus oduberi is a small, delicate insect that resembles species in the *E. marini* species-complex in its general appearance, coloration and sculpture, though it differs in having the mandible much less strongly twisted. *E. oduberi* may easily be recognized by its colour pattern, glabrous marginal cell, very unequal mid tibial spurs and usually having *cu-a* slightly distal to the base of *Rs&M*.

BIOLOGICAL INFORMATION. Only two females of *Enicospilus oduberi* have been collected. They were taken in Santa Rosa National Park, Costa Rica, at the end of the dry season. Nothing else is known about their biology.

MATERIAL EXAMINED

Holotype ♀, **Costa Rica**: Guanacaste Prov., Santa Rosa National Park, 300 m, iv.1983 (*Janzen & Hallwachs*) (BMNH).

Paratype. **Costa Rica**: Guanacaste Prov.: 1 ♀, Santa Rosa National Park, 300 m, iv.1984 (*Janzen & Hallwachs*) (BMNH).

Enicospilus gallegosi sp. n.

(Figs 129, 139, 335)

DESCRIPTION. Mandibles moderately long, proximally evenly narrowed, distally almost parallel-sided, apically twisted 20–30°; upper mandibular tooth from subcylindrical to slightly depressed, 1.6–1.8 times as long as the lower tooth; outer mandibular surface bearing fine sparse long hair, distally more or less flat, proximally with a shallow concavity. Labrum 0.2 times as long as broad; malar space 0.3–0.4 times as long as basal mandibular width. Clypeus in profile flat, margin thin; clypeus in front view 1.3–1.6 times as broad as long, with margin truncate apically. Lower face 0.70–0.75 times as broad as long, centrally smooth and polished with fine, inconspicuous punctures. Head in dorsal view with genae constricted behind eyes; posterior ocellus more or less contiguous with eye; FI = 73–78%; occipital carina mediodorsally complete, ventrally curved to join hypostomal carina about 0.6–0.7 times the basal mandibular width away from mandible. Antenna long and slender, with 51–54 flagellar segments; 20th segment 2.0–2.3 times as long as broad.

Mesoscutum polished, finely punctate, in profile abruptly rounded; notauli vestigial. Mesopleuron polished, the upper part punctate or punctostriate, the lower part from punctostriate to striate; epicnemial carina curved towards, but not reaching, anterior margin of pleuron. Scutellum in profile moderately convex, laterally carinate for 0.8 or more of its length; scutellum in dorsal view 1.4–1.5 times as long as anteriorly broad, polished, anteriorly smooth but posteriorly with scattered longitudinal wrinkles. Metapleuron moderately convex, diagonally rugoso-striate or striate; submetapleural carina evenly anteriorly broadened; posterior transverse carina of mesosternum complete. Propodeum in profile evenly declivous; anterior transverse carina usually weak at extreme lateral ends, sometimes complete, posterior transverse carina absent; anterior area short, steep irregularly rugose; spiracular area quite long, smooth or finely punctate; posterior area transversely wrinkled, with the wrinkles tending to be concentric except often with an irregularity along median line; lateral longitudinal carina complete, not joined to spiracular margin by a short carina.

Fore wing length 9–12 mm; discosubmarginal cell as in Fig. 335; AI = 1.20–1.80; CI = 0.20–0.37; ICI = 0.33–0.50; SDI = 1.20–1.36; *cu-a* proximal to the base of *Rs&M* by 0.1–0.3 times its own length; marginal cell proximally broadly glabrous; 1st subdiscal cell fairly evenly but sparsely hirsute, proximally glabrous. Hind wing with 5–6 hamuli on *R*1; 1st abscissa of *Rs* straight (Fig. 129), 2nd abscissa more or less straight.

Fore leg with tibia slightly flattened, with scattered spines on outer surface. Mid leg with longer tibial spur 1.4–1.5 times length of the shorter. Hind leg with coxa in profile 1.7–1.9 times as long as deep; trochantellus dorsally 0.4–0.6 times as long as broad (Fig. 139); 4th segment of tarsus 2.5–2.7 times as long as broad; claws of female rather short, evenly curved with stout sparse pectinae, those of male similar but with pectinae shorter.

Gaster slender; tergite 2 in profile more than 6 times as long as posteriorly deep, laterotergite folded under, thyridia elliptical and separated from anterior margin of tergite by about 3 times its own length. Ovipositor short, straight, its sheath narrow. Male with sternites 7–9 bearing scattered long stout, slightly curved erect hairs; gonosquama apically subacute.

Colour generally yellowish, with three dark brown longitudinal mesoscutal vittae, and sometimes with an indistinct dark mark near upper hind corner of mesopleuron; interocellar area yellow, but sometimes with a slight trace of infuscation between the posterior ones; antenna golden; pterostigma yellow; wings hyaline.

VARIATION. The Brazilian specimens have the alitrunk laterally smoother and more polished than Central American specimens.

REMARKS. This species is named in honour of Luis Roberto Gallegos for his imaginative interactions with Guanacaste National Park in its formative days.

Enicospilus gallegosi resembles several other Central American species, especially *E. hemicrescellae* (see p. 294). However, *E. gallegosi* may be distinguished from all others by the following combination of characters: the distal sclerite is distinctly separated from the proximal sclerite; the proximal corner of the marginal cell of the fore wing is broadly glabrous (Fig. 335); the hind trochantellus projects dorsally well beyond the distal end of the trochanter; the lateral longitudinal carina of the propodeum is complete and not joined to the spiracular margin; AI is relatively large.

BIOLOGICAL INFORMATION. *Enicospilus gallegosi* is a rather rarely collected species that has a range which extends from about 17°N in southern Mexico south to about 14°S in Brazil. A single damaged specimen in the BMNH is labelled as 'St. Dom' and is believed to have originated from the Dominican Republic, although no other specimens of this species are known from the Caribbean.

In Santa Rosa National Park isolated specimens of *E. gallegosi* have been collected during the first half of the wet season. Nothing is known of its biology.

MATERIAL EXAMINED

Holotype ♂, **Costa Rica**: Guanacaste Prov., Santa Rosa National Park, 300 m, vii.1982 (*Janzen & Hallwachs*) (BMNH).

Paratypes. **Brazil**: 2 ♀, Bahia, Encruzilhada, 960 m, iii & xi.1972 (*Alvarenga*) (TC); 1 ♂, 3 ♀, same locality and collector, 980 m, xi.1974 (TC). **Costa Rica**: Guanacaste Prov.: 1 ♂, 1 ♀, Santa Rosa National

Park, 300m, viii.1982, vi.1984 (*Janzen & Hallwachs*) (BMNH). **Dominican Republic**: 1 ♀, 'St Dom.' no further data (BMNH). **Mexico**: Chiapas: 2 ♀, 32 km N. Huixtla, 1000 m, vi.1969 (CNC). **Panama**: 1 ♀, Barro Colorado Island, 120 m, vi.1985 (*Wolda*) (BMNH).

Enicospilus parkeri sp. n.

(Figs 210, 336)

Description. Mandibles quite long and stout, proximally strongly narrowed, distally almost parallel-sided, apically twisted 40–50°; upper mandibular tooth subcylindrical, 1.4–1.7 times as long as the lower tooth; outer mandibular surface sparsely pubescent, distally concave, and with a broad shallow proximal concavity. Labrum 0.2–0.3 times as long as broad; malar space 0.3–0.4 times as long as basal mandibular width. Clypeus in profile flat, margin subacute; clypeus in front view 1.5–1.7 times as broad as long, with margin subtruncate apically. Lower face 0.71–0.80 times as broad as long, centrally polished, punctate. Head in dorsal view with genae slightly inflated behind eyes; posterior ocellus very close to or contiguous with the eye; FI = 70–75%; occipital carina mediodorsally complete, ventrally curved to join hypostomal carina about 0.5–0.7 times the basal mandibular width away from mandible. Antenna long and quite slender, with 61–68 flagellar segments; 20th segment 1.8–2.1 times as long as broad.

Mesoscutum from polished and finely punctate to matt, inconspicuously granulate, in profile abruptly rounded; notauli vestigial. Mesopleuron polished, the upper part punctate to punctostriate, the lower part punctostriate to striate, often with longitudinal wrinkling near ventral corner; epicnemial carina inclined towards anterior margin of pleuron. Scutellum in profile moderately convex, laterally carinate for 0.6 or more of its length; scutellum in dorsal view 1.4–1.5 times as long as anteriorly broad, punctate, though often with irregular rugosities present. Metapleuron ventrally flattened, punctate to puncto-coriaceous or even almost striate, and postero-dorsally with a ridge that usually bears rugae (Fig. 210); submetapleural carina evenly anteriorly broadened; posterior transverse carina of mesosternum complete. Propodeum in profile abruptly declivous; anterior transverse carina complete except at lateral extremities, posterior transverse carina absent or present as a sublongitudinal crest laterally; anterior area short, steep, bearing isolated striae; spiracular area moderately long, smooth; posterior area irregularly rugose, usually with rugosities centrally tending to form longitudinal striae; lateral longitudinal carina present anteriorly, joined to spiracular margin by a short weak carina.

Fore wing length 17–22 mm; discosubmarginal cell as in Fig. 336; AI = 1.06–1.18; CI = 0.40–0.62; ICI = 0.42–0.52; SDI = 1.39–1.53; *cu-a* proximal to the base of *Rs&M* by 0.2–0.4 times its own length; marginal cell proximally broadly glabrous; 1st subdiscal cell with distal end and anterior 0.4 hirsute. Hind wing with 8–9 hamuli on *R*1; 1st abscissa of *Rs* more or less straight, 2nd abscissa weakly bowed.

Fore leg with tibia subcylindrical, with scattered spines on outer surface. Mid leg with longer tibial spur 1.3–1.5 times length of the shorter. Hind leg with coxa in profile 1.7–1.9 times as long as deep; trochantellus dorsally <0.1 times as long as broad; 4th segment of tarsus 2.5–2.8 times as long as broad; claws of female short, apically abruptly curved, with fine close pectinae; those of male very similar but with pectinae closer.

Gaster slender; tergite 2 in profile 6–7 times as long as posteriorly deep, laterotergite folded under, thyridia elliptical and separated from anterior margin of tergite by about 4.0–4.5 times its own length. Ovipositor slender, straight, its sheath narrow. Male with sternites 7–9 bearing dense long erect pubescence; gonosquama long, apically rounded.

Colour generally pale yellowish, though often with indistinct darker brownish marks, especially on mesoscutum; gaster with dorsal margins of most tergites infuscate or blackish, often more extensively dark-marked; interocellar area usually yellowish, sometimes weakly infuscate; antenna golden, but generally infuscate apically; pterostigma yellowish; wings hyaline or weakly infumate.

Variation. The most striking variation in this species is in the colour of the gaster. All specimens have at least the dorsal margin of tergites 3–6 blackish, and often the lateral parts of the same tergites very pallid. Some individuals have the posterior and ventral parts of the tergites infuscate so the darker patterning is somewhat scalariform in lateral view. A possibly conspecific specimen from Brazil, that has been excluded from the paratype series, is rather uniformly yellowish brown.

Remarks. This species is named in honour of Pam Parker for her tireless efforts in conservation biology.

Enicospilus parkeri belongs to the *E. dispilus* species-complex, an exceptionally difficult species group to resolve as several species show great variation. *E. parkeri* may be separated from most other species with a central sclerite and golden antennae by the fact that the central sclerite is crescentic, the fenestra is rather small and the posteromedial part of *Rs+2r* has a weak swelling opposite the anterior end of the proximal sclerite (Fig. 336). In these features it resembles *E. georginae* (Fig. 338) and some northern American specimens of *E. dispilus*, and care is required to separate these three taxa. Their critical features are compared below.

	dispilus	*parkeri*	*georginae*
anterior propodeal transverse carina	incomplete	complete	complete
CI	<0.40	0.40–0.62	0.59–0.79
metapleuron posterodorsally	punctate	rugose/ striate	rugose/ striate
marginal cell of fore wing	proximally glabrous	proximally glabrous	more or less hirsute
1st abscissa of *Rs* in hind wing	straight	straight	bowed

In Costa Rica most specimens of *E. parkeri* have only the dorsum of the gaster narrowly black and the female subgenital plate infuscate. *E. georginae* always has the gaster mottled.

BIOLOGICAL INFORMATION. *Enicospilus parkeri* is a Mesoamerican species that is known to occur from about 19°N in southern Mexico south to 8°N in northern Panama, and I have seen a single, possibly conspecific male from Brazil. It has been collected in lower montane rainforests at altitudes between 600 and 1500 m, though large numbers of individuals have never been collected at any one site. At Monteverde, Costa Rica, where most specimens have been taken, isolated individuals have been collected in January, May, July and August. Despite intensive collecting *E. parkeri* has never been taken in lowland sites such as Santa Rosa and Barro Colorado. The hosts of this species are not known.

MATERIAL EXAMINED

Holotype ♀, **Costa Rica**: Guanacaste Prov., Estacion Mengo, SW. side of Volcán Cacao, 1100 m, vi.1987 (*Janzen*) (BMNH).

Paratypes. **Costa Rica**: Alajuela Prov.: 1 ♂, Finca San Gabriel, 16 km E. Quebrada Grande, 630 m, iii.1983 (*Janzen & Hallwachs*) (BMNH): Cartago Prov.: 1 ♂, Tapanti, Río Grande de Orosi, 13–1400 m, i.1985 (*Janzen & Hallwachs*) (BMNH): Puntarenas Prov: 1 ♀, Monteverde, 1300 m, vii.1981 (*Janzen & Hallwachs*) (BMNH); 1 ♂, same locality, v.1984 (*Fogden*) (BMNH); 2 ♀, same locality, viii.1985, i.1986 (*Haber*) (BMNH): San José Prov.: 1 ♀, Estacion Zurqui (el Tunel), Braulio Carrillo National Park, 1500 m, xi.1985 (*Chacon & Chacon*) (BMNH). **Mexico**: Oaxaca: 1 ♀, 19 km S. Valle Nacional, 1000 m, v.1971 (*Howden*) (TC). **Panama**: 4 ♀, Chiriqui, Fortuna, 1050 m, ii, iv & v.1978 (*Wolda*) (RNH).

Non-paratypic material. **Brazil**: 1 ♀, Santa Catarina, Nova Teutonia, i.1939 (*Plaumann*) (BMNH).

Enicospilus ulfstrandi sp. n.

(Fig. 337)

DESCRIPTION. Mandibles moderately long, distally evenly tapered, apically twisted 15–25° with upper tooth depressed, 1.3–1.6 times as long as the lower; outer mandibular surface slightly concave with a weak proximal concavity bearing fine hairs. Labrum 0.2–0.3 times as long as broad; malar space 0.3 times as long as basal mandibular width. Clypeus in profile almost flat, margin blunt; clypeus in front view 1.2–1.3 times as broad as long, apically more or less truncate. Lower face 0.65–0.70 times as broad as long, polished, centrally punctostriate, laterally punctate. Head in dorsal view with genae constricted; posterior ocellus contiguous with eye; FI = 65–70%; occipital carina mediodorsally complete, ventrally curved to join hypostomal carina about 0.7 times the basal mandibular width away from mandible. Antenna slender, with 53–56 flagellar segments; 20th segment 2.1–2.3 times as long as broad.

Mesoscutum polished, punctate, in profile abruptly rounded; notauli absent. Mesopleuron weakly polished, the upper part punctostriate to striate, the lower part rugose-striate; epicnemial carina curved towards anterior margin of pleuron. Scutellum in profile weakly convex, laterally carinate for at least 0.5 of its length, sometimes completely carinate; scutellum in dorsal view 1.4–1.6 times as long as anteriorly broad, anteriorly smooth, posteriorly wrinkled. Metapleuron weakly evenly convex, from striate to finely irregularly rugose; submetapleural carina evenly anteriorly broadened; posterior transverse carina of mesosternum complete. Propodeum in profile evenly declivous; anterior transverse carina complete, posterior transverse carina absent; anterior area steep, rugose-striate; spiracular area moderately long, smooth; posterior area finely irregularly reticulate, sometimes tending to be longitudinally striate medially; lateral longitudinal carina complete anteriorly, posteriorly rather irregular, sometimes absent, the anterior part sometimes joined to spiracular margin by a weak short carina.

Fore wing length 11–13 mm; discosubmarginal cell as in Fig. 337; AI = 0.52–0.91; CI = 0.12–0.25; ICI = 0.38–0.53; SDI = 0.95–1.08; *cu-a* from opposite to proximal to the base of *Rs&M* by about 0.2 of its own length; marginal cell proximally very slightly more sparsely hirsute than centrally; 1st subdiscal cell with anterior and distal parts hirsute. Hind wing with 5–6 hamuli on *R*1; 1st abscissa of *Rs* very weakly bowed, 2nd abscissa straight.

Fore leg with tibia strongly flattened, with isolated spines on outer surface. Mid leg with longer tibial spur 1.4–1.6 times length of the shorter. Hind leg with coxa in profile 1.9–2.0 times as long as deep; trochantellus dorsally 0.1–0.2 times as long as broad; 4th segment of tarsus 2.7–2.8 times as long as broad; claws of female quite long, apically evenly curved, with long close pectinae, those of male with pectinae slightly shorter.

Gaster slender; tergite 2 in profile more than 5 times as long as posteriorly deep, laterotergite turned under, thyridia elliptical and separated from anterior margin of tergite by about 4 times its own length. Ovipositor slender, straight, its sheath narrow. Males with sternites 7–9 bearing scattered long erect, rather fine hairs; gonosquama evenly rounded.

Colour generally yellowish brown; mesoscutum usually slightly darker anteriorly on central lobe, sometimes with darker longitudinal vittae; interocellar area yellow; antenna yellowish with distal few segments slightly infuscate; pterostigma golden; wings hyaline.

VARIATION. The Mexican specimens have the meso- and metapleurae more uniformly and finely striate than the Costa Rican ones which always have a rugose metapleuron, and sometimes have similar sculpture on the lower part of the mesopleuron. The Ecuadorian specimen is morphologically very similar to the Mexican ones, but has dark mesoscutal vittae and has segments 3+ of the gaster infuscate.

REMARKS. This species is named in honour of Staffan Ulfstrand in recognition of his deep interest in Costa Rican biology and conservation.

Enicospilus ulfstrandi may be distinguished from other Mesoamerican species by the characteristically small circular central sclerite and by the faint, but generally wide, distal sclerite (Fig. 337). The sculpture, venation and form of the mandibles suggest that *E. ulfstrandi* belongs to the *E. dispilus* species-group, but no other Central American species in this complex has such a small central sclerite.

BIOLOGICAL INFORMATION. *Enicospilus ulfstrandi* is a rather widespread species whose range extends from southern Florida and the extreme south of Texas southwards throughout Mexico to Venezuela and Ecuador (Map 31). In Costa Rica most individuals have been collected in the seasonally dry forests of Santa Rosa National Park. The cumulative distributional data for this site for 1982–86 are:

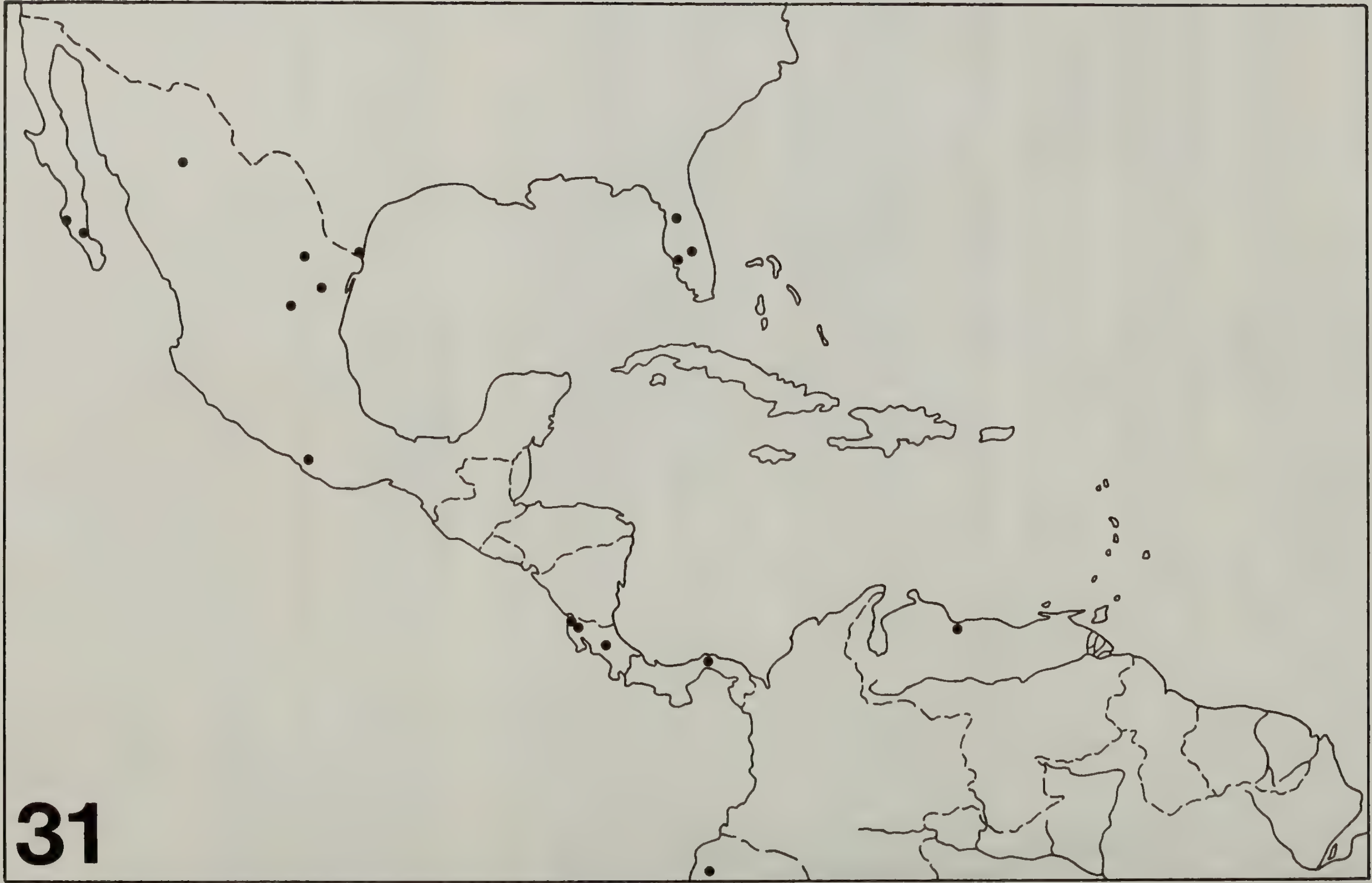
J	F	M	A	M	J	J	A	S	O	N	D
1	1	5	2	2	–	–	–	–	–	–	–

These data indicate that *E. ulfstrandi* is present during the dry season, and the collecting peak (March/April) corresponds with the driest time of the year when no hosts apparently are present. *E. ulfstrandi* also has never been collected in wet forest sites such as Monteverde, though a single individual was collected at light on Barro Colorado Island. Quite what the hosts of this species are in Guanacaste remains a mystery.

MATERIAL EXAMINED

Holotype ♀, **Costa Rica**: Guanacaste Prov., Santa Rosa National Park, 300 m, iii.1984 (*Janzen & Hallwachs*) (BMNH).

Paratypes. **Costa Rica**: Guanacaste Prov.: 1 ♀, Cerro el Hacha, 3–400 m, xi.1986-i.1987 (*Janzen & Hallwachs*) (BMNH); 1 ♀, Rincón de la Vieja, Mirador, 900 m, iii.1984 (*Janzen, Hallwachs & Gauld*) (BMNH); Santa Rosa National Park, 300 m, 1 ♀, iii.1982, 1 ♂, i.1983, 1 ♀, iii.1983, 1 ♀, iv.1983, 1 ♂, ii.1984, 2 ♀, iii.1984, 2 ♀, v.1984 (*Janzen & Hallwachs*) (BMNH); 1 ♀, same locality, iv.1984 (*Gauld*) (BMNH): San José Prov.: 1 ♀, San Antonio de Escazú, 1300 m, v-vi.1981 (*Eberhard*) (UMC). Ecuador: 1 ♀, Río León, 2100 m, xi.1970 (*Peña*) (TC). Mexico: Baja California: 2 ♀, 8.5 km N. La Paz on highway 1, xii.1978 (*Weismann et al.*) (CAS); 1 ♂, San Domingo, vii.1938 (*Michelbacher & Ross*) (CAS): Guerrero: 1 ♀, Tepetlapa, 100m, x.1904 (*Smith*) (BMNH): Nuevo Leon: 2 ♀, 8 km S. Monterrey, vii.1963 (*Howden*) (CNC); 1 ♀, Monterrey, Huasteca Canyon, vii.1963 (*Howden*) (CNC): Chihuahua: 1 ♂, 1 ♀, Presidio, 1904 (*Godman-Salvin*) (BMNH): San Luis Potosí: 1 ♀, El Salto Falls, vi.1963 (*Woodruff*) (FSCA): Tamaulipas: 1 ♂, Mesa de Llera, nr Cuidad Victoria, vi.1977 (*Porter & Cerbone*) (FSCA). **Panama**: 1 ♂, Barro Colorado Island, 120 m, vii.1983 (*Wolda*) (BMNH). **U.S.A.**: Florida: 1 ♀, Highlands Co., vi.1967



Map 31 Localities at which *Enicospilus ulfstrandi* has been collected.

(*Heinrich*) (CNC); 1 ♀, same locality, vi.1979 (*Weems & Webber*) (FSCA); 1 ♀, same locality, i.1980 (*Weems & Carrel*) (FSCA); 1 ♂, Levy Co., Williston, xii.1949 (*Townes*) (TC); Pinellas Co., 1 ♂, Tarpon Springs, xii.1949 (*Townes*) (TC): Texas: 1 ♀, Cameron Co., palm jungle near Southmost, vi.1948 (*Mason*) (CNC). **Venezuela**: 2 ♀, Aragua, Portachuelo Pass, nr Rancho Grande, iv.1960 (*Test*) (UMC); 1 ♀, Aragua, Rancho Grande, iv.1960 (*Test*) (UMC).

Enicospilus georginae sp. n.

(Figs 144, 338)

DESCRIPTION. Mandibles quite long and stout, proximally strongly narrowed, distally almost parallel-sided, apically twisted 30–50°; upper mandibular tooth subcylindrical, 1.4–1.7 times as long as the lower tooth; outer mandibular surface sparsely pubescent, distally concave, and with a broad shallow proximal concavity. Labrum 0.3 times as long as broad; malar space 0.3 times as long as basal mandibular width. Clypeus in profile weakly convex, margin blunt; clypeus in front view 1.4–1.5 times as broad as long, with margin subtruncate apically. Lower face 0.69–0.72 times as broad as long, centrally polished, punctate. Head in dorsal view with genae constricted behind eyes; posterior ocellus very close to or contiguous with the eye; FI = 70–75%; occipital carina mediodorsally complete, ventrally curved to join hypostomal carina about 0.7 times the basal mandibular width away from mandible. Antenna long and quite stout, with 63–67 flagellar segments; 20th segment 1.9–2.0 times as long as broad.

Mesoscutum polished and finely punctate, in profile evenly rounded; notauli vestigial. Mesopleuron polished, the upper part punctate to punctostriate, the lower part striate, with longitudinal wrinkling near ventral corner; epicnemial carina curved towards anterior margin of pleuron. Scutellum in profile moderately convex, laterally carinate for 0.6–0.8 of its length; scutellum in dorsal view 1.2–1.3 times as long as anteriorly broad, punctate. Metapleuron ventrally flattened, punctate and postero-dorsally with a ridge that bears weak rugae or striations; submetapleural carina evenly anteriorly broadened; posterior transverse carina of mesosternum complete. Propodeum in profile abruptly declivous; anterior transverse carina complete, posterior transverse carina present as a sublongitudinal crest laterally; anterior area short, steep, bearing isolated striae; spiracular area moderately long, smooth; posterior area irregularly rugose, with rugosities centrally tending to form longitudinal striae; lateral longitudinal carina complete, joined to spiracular margin by a short discontinuous carina.

Fore wing length 21–23 mm; discosubmarginal cell as in Fig. 338; AI = 0.86–1.11; CI = 0.59–0.79; ICI = 0.43–0.50; SDI = 1.28–1.42; *cu-a* proximal to the base of *Rs&M* by 0.3–0.5 times its own length; marginal cell proximally only very slightly more sparsely hirsute than it is centrally, with a very narrow glabrous area adjacent to *Rs+2r*; 1st subdiscal cell with anterior 0.4 hirsute. Hind wing with 7–10 hamuli on *R*1; 1st abscissa of *Rs* distinctly bowed (Fig. 144), 2nd abscissa from almost straight to weakly arcuate.

Fore leg with tibia subcylindrical, with scattered spines on outer surface. Mid leg with longer tibial spur 1.4–1.6 times length of the shorter. Hind leg with coxa in profile 1.8–1.9 times as long as deep; trochantellus dorsally <0.1 times as long as broad; 4th segment of tarsus 2.0–2.2 times as long as broad, unusual in that it bears denser, long fine pubescence than many species; claws of female quite short, apically abruptly curved, with fine, close pectinae; claws of male similar.

Gaster slender; tergite 2 in profile about 7 times as long as posteriorly deep, laterotergite folded under, thyridia elliptical and separated from anterior margin of tergite by about 3.0 times its own length. Ovipositor slender, straight, its sheath moderately stout. Male with sternites 7–9 bearing dense long erect pubescence; gonosquama apically rounded.

Colour generally pale yellowish brown, with head, pronotum, mesoscutal stripes, scutellum, upper and lower hind parts of mesopleuron, metanotum laterally, and metapleuron in part bright yellow; gaster with ventral and posterior margins of tergites 3–6 infuscate, anterocentral parts of same tergites pale yellow so the gaster appears mottled; interocellar area yellowish; antenna golden; pterostigma yellowish; wings moderately strongly infumate, yellowish.

VARIATION. None remarkable.

REMARKS. This species is named after Pensión Georgina, on the Cerro de la Muerte, Costa Rica, for providing food and shelter for many a cold tropical biologist.

Enicospilus georginae is a large species that is most easily distinguished by the mottled coloration of the gaster, the large value of CI, the very obtuse posterodistal corner of the 2nd discal cell, the yellowish wings and the crescent-shaped central sclerite (Fig. 338). Structurally it is very similar to *E. parkeri* (see p. 287).

BIOLOGICAL INFORMATION. In Mesoamerica, *Enicospilus georginae* is found at higher altitudes than almost any other species in the genus. It has only been collected above 2000 m in tall oak forest in Costa Rica, and specimens have been taken in a similar habitat in northern Panama. Its hosts are not known.

MATERIAL EXAMINED

Holotype ♀, **Panama**: Chiriqui Prov., Guadalupe Arriba, 2200 m, vi.1984 (*Wolda*) (BMNH).

Paratypes. **Costa Rica**: San José Prov.: 1 ♂, 1 ♀, San Gerardo de Dota, Cerro de la Muerte, 2430 m, xii.1981 (*Janzen & Hallwachs*) (BMNH). **Panama**: 3 ♀, Chiriqui, Guadalupe Arriba, 2200 m, iii-vi.1984/5 (*Wolda*) (BMNH).

Enicospilus masoni sp. n.

(Figs 141, 339)

DESCRIPTION. Mandibles moderately long, distally fairly evenly narrowed, apically twisted 35–45°; upper mandibular tooth subcylindrical, 1.5–1.8 times as long as the lower tooth; outer mandibular surface sparsely pubescent, flat, with a weak proximal concavity. Labrum 0.3–0.4 times as long as broad; malar space 0.3–0.4 times as long as basal mandibular width. Clypeus in profile flat or very weakly convex, margin blunt; clypeus 1.3–1.5 times as broad as long, margin apically subtruncate. Lower face 0.67–0.71 times as broad as long, polished, centrally punctate. Head in dorsal view with genae rounded behind eye; posterior ocellus very close to eye; FI = 70–75%; occipital carina mediodorsally complete, ventrally curved to join hypostomal carina about 0.6 times the basal mandibular width away from mandible. Antenna long and slender, with 63–65 flagellar segments; 20th segment 2.4–2.5 times as long as broad.

Mesoscutum polished, punctate, in profile abruptly rounded; notauli vestigial. Mesopleuron polished, the upper and lower parts punctate, with a few irregular weak rugae radiating posteriorly from the epicnemial carina; epicnemial carina curved towards anterior margin of pleuron. Scutellum in profile weakly convex, laterally carinate for 0.8 or more of its length; scutellum in dorsal view 1.4–1.5 times as long as anteriorly broad, punctate with isolated rugae posteriorly. Metapleuron evenly weakly convex, punctate with isolated rugae; submetapleural carina evenly anteriorly broadened; posterior transverse carina of mesosternum complete. Propodeum in profile evenly declivous; anterior transverse carina sinuous, usually complete, sometimes lateromedially interrupted, posterior transverse carina absent; anterior area short, steep, bearing irregular striae; spiracular area short, punctate; posterior area irregularly rugose-reticulate; lateral longitudinal carina present anteriorly, joined to spiracular margin by a short carina.

Fore wing length 15–17 mm; discosubmarginal cell as in Fig. 339; AI = 0.86–1.07; CI = 0.61–0.83; ICI = 0.43–0.50; SDI = 1.31–1.50; *cu-a* proximal to *Rs&M* by 0.1–0.3 times its own length; marginal cell proximally uniformly hirsute; 1st subdiscal cell with anterior and distal parts broadly hirsute. Hind wing with 7 hamuli on *R*1; 1st abscissa of *Rs* more or less straight (Fig. 141), 2nd abscissa arcuate.

Fore leg with tibia very slightly flattened, with scattered stout spines on outer surface. Mid leg with longer tibial spur 1.3–1.5 times length of the shorter. Hind leg with coxa in profile 1.8–1.9 times as long as deep; trochantellus dorsally <0.1 times as long as broad; claws of female moderately long, evenly curved, with close, rather short pectinae; claws of male similar.

Gaster long and slender; tergite 2 in profile more than 5 times as long as posteriorly deep, laterotergite turned under, thyridia elliptical and separated from anterior margin of tergite by about 3–4 times its own length. Ovipositor straight, apically very slender, its sheath quite narrow. Male with sternites 7–9 bearing exceptionally long stout erect hairs; gonosquama evenly rounded apically.

Colour generally yellowish, with the central mesoscutal vitta slightly to moderately infuscate, and with the posterior tergites of the gaster from not to moderately strongly infuscate; interocellar area yellowish; antenna brownish yellow, often infuscate distally; pterostigma yellowish brown; wings hyaline.

VARIATION. The female from Monteverde, Costa Rica, differs from other specimens in having the base of the antennae black, the upper part of the mesopleuron punctostriate and the lower part rugose, the metapleuron exceptionally rugose, the lateral longitudinal carina complete and tergites 3+ of the gaster black. This Costa Rican specimen is only tentatively regarded as conspecific, and is excluded from the paratype series.

REMARKS. This species is named in honour of the distinguished Canadian entomologist, Dr Bill Mason, who collected a large number of ophionines in tropical Mexico.

Enicospilus masoni can most easily be recognized by the form of the alar sclerites and by the large CI (Fig. 333). The form of the mandibles and its general sculpture suggest it belongs to the *E. dispilus* species-group.

BIOLOGICAL INFORMATION. *Enicospilus masoni* has most commonly been collected in Mexico where occasional individuals have been taken from about 24°N in Durango south to southern Chiapas (15°N). A single, possibly conspecific individual from Costa Rica suggests it may occur throughout Central America. Nothing is known of the hosts of this insect.

MATERIAL EXAMINED

Holotype ♀, **Mexico:** Atoyac, v.1904 (*Smith*) (BMNH).

Paratypes. **Mexico**: Chiapas: 1 ♀, Muste, nr Huixtla, 440 m, ix.1970 (*Welling*) (CNC): Durango: 1 ♂, 10 km S. Durango, 2000 m, vii.1964 (*Mason*) (CNC); 1 ♀, 48 km W. La Cuidad, 2100m, vi1964 (*Mason*) (CNC): Sinaloa: 1 ♀, 42 km N. of Pericos, viii.1960 (*Arnaud, Ross & Rentz*) (CAS): Veracruz: 1 ♀ Fortin de las Flores, Sumidero, Cerveceria Ing. D. Rabago Res., 700–1000 m, v.1965 (*Weems*) (FSCA).

Non-paratypic material. **Costa Rica**: 1 ♀, Puntarenas Prov., Monteverde, ii.1984 (*Cameron*) (WC).

Enicospilus kleini sp. n.

(Figs 212, 340)

DESCRIPTION. Mandibles moderately long, proximally strongly narrowed, distally weakly narrowed, apically twisted 25–35°; upper mandibular tooth slender, depressed, 1.2–1.5 times as long as the lower tooth; outer mandibular surface bearing fine pubescence, centrally slightly concave, proximally more or less flat. Labrum 0.2–0.3 times as long as broad; malar space 0.3–0.4 times as long as basal mandibular width. Clypeus in profile almost flat, margin blunt; clypeus in front view 1.3–1.5 times as broad as long, with margin truncate or subtruncate apically. Lower face 0.63–0.71 times as broad as long, polished, punctate, centrally sometimes tending to punctostriate. Head in dorsal view with genae constricted behind eye; posterior ocellus very close to eye; FI = 70–75%; occipital carina mediodorsally complete, ventrally curved to join hypostomal carina about 0.7–0.9 times the basal mandibular width away from mandible. Antenna long and slender, with 54–59 flagellar segments; 20th segment 2.1–2.4 times as long as broad.

Mesoscutum polished, finely punctate, in profile quite steeply rounded; notauli vestigial. Mesopleuron polished, the upper part generally sparsely punctate, sometimes ventrally tending to punctostriate, the lower part usually punctostriate, occasionally striate or even punctate; epicnemial carina inclined towards anterior margin of pleuron. Scutellum in profile moderately convex, laterally carinate for 0.8 or more of its length; scutellum in dorsal view 1.4–1.6 times as long as anteriorly broad, from polished and finely punctate to bearing transverse rugae. Metapleuron weakly convex, diagonally striate (Fig. 212), the striae sometimes coarse and rather irregular; submetapleural carina generally rather narrow and anteriorly rather abruptly broadened into a small rounded lobe; posterior transverse carina of mesosternum complete. Propodeum quite long, in profile evenly declivous; anterior transverse carina complete except for lateral extremities, posterior transverse carina absent; anterior area short, steep striate; spiracular area long, smooth; posterior area irregularly rugose, sometimes with the rugae tending to be somewhat concentric; lateral longitudinal carina generally only present anteriorly, joined to spiracular margin by a short carina.

Fore wing length 12–16 mm; discosubmarginal cell as in Fig. 340; AI = 0.86–1.11; CI = 0.21–0.29; ICI = 0.47–0.57; SDI = 1.12–1.31; *cu-a* proximal to the base of *Rs&M* by 0.1–0.3 times its own length; marginal cell proximally slightly more sparsely hirsute than it is centrally; 1st subdiscal cell with anterior and distal margins hirsute. Hind wing with 6–8 hamuli on *R*1; 1st abscissa of *Rs* straight, 2nd abscissa straight.

Fore leg with tibia slightly flattened, with scattered inconspicuous spines on outer surface. Mid leg with longer tibial spur 1.5–1.6 times length of the shorter. Hind leg with coxa in profile 1.8–1.9 times as long as deep; trochantellus dorsally 0.1 times as long as broad; 4th segment of tarsus 2.4–2.9 times as long as broad; claws of female moderately long, apically evenly curved with long fairly widely interspaced pectinae; claws of male similar but with pectinae a little finer, shorter and closer together.

Gaster long and slender; tergite 2 in profile 5.5–6.5 times as long as posteriorly deep, laterotergite folded under, thyridia elliptical to oval and separated from anterior margin of tergite by 3–5 times its own length. Ovipositor slightly decurved, its sheath quite narrow. Male with sternites 7–9 bearing numerous long stout erect hairs; gonosquama apically evenly rounded.

Colour generally brownish yellow, with central and sometimes also the lateral mesoscutal vittae darker brown; interocellar area yellowish, very rarely slightly infuscate between the posterior ocelli; antenna yellowish; pterostigma yellowish brown; wings hyaline.

VARIATION. None remarkable.

REMARKS. This species is named in honour of William Klein for his many contributions to the development of Guanacaste National Park, Costa Rica.

Enicospilus kleini is most easily recognized by the characteristic form of the central sclerite in the fore wing (Fig. 340). Structurally it is very similar to an undescribed species from southern Brazil (BMNH, CNC) but differs in having *Rs+2r* more sinuous and erect hairs on the posterior sternites of the male gaster.

BIOLOGICAL INFORMATION. *Enicospilus kleini* is a widespread Neotropical species whose range extends from 18°N in southern Mexico, south to about 23°S in Brazil. It seems to be associated with dry or semidry areas, and in Costa Rica it has only been collected in the seasonally dry parts of Guanacaste Province. In Santa Rosa National Park most specimens have been collected in the dry season. The cumulative seasonal distribution for 1980–85 is:

J	F	M	A	M	J	J	A	S	O	N	D
4	1	4	1	2	2	1	–	–	–	–	1

Nothing is known of the natural history of this species.

MATERIAL EXAMINED

Holotype ♀, **Costa Rica**: Guanacaste Prov., Santa Rosa National Park, 300 m, iii.1983 (*Janzen & Hallwachs*) (BMNH).

Paratypes. **Brazil**: 1 ♂, 34 ♀, Bahia, Encruzilhada, 960–980 m, xi.1972–4 (*Alvarenga*) (TC); 2 ♀, Ceara, Barbalha, 400 m, v.1969 (*Alvarenga*) (TC); 8 ♀, Minas Gerais, Aguas Vermelhas, 800 m, xii.1983 (*Alvarenga*) (TC); 3 ♀, Minas Gerais, Pedra Azul, 800 m, xi.1971–2 (*Alvarenga & Seabra*) (TC); 1 ♀, São Paulo, Boracea Salesopolis, xii.1969 (*Campbell*) (CNC). **Colombia**: 1 ♀, Amazon River, Monkey Island, nr Leticia, ix.1979 (*Tidwell*) (USNM). **Costa Rica**: Guanacaste Prov.: 1 ♀, W. of Carmona Nicoya, 600–700 m, viii.1982 (*Janzen & Hallwachs*) (BMNH); Santa Rosa National Park, 300 m, 1 ♀, vii.1980, 1 ♂, iii.1982, 4 ♀, i.1983, 1 ♂, 2 ♀, iii-v.1983, 1 ♀, xii.1983, 2 ♀, ii-iii.1984, 2 ♀, v-vi.1984 (*Janzen & Hallwachs*) (BMNH); 1 ♀, same locality, vi.1985 (*Gauld*) (BMNH); 1 ♀, Volcán Orosi, Casa Mariksa (= Maritza), 800 m, vii.1986 (*Gauld*) (BMNH). **Ecuador**: 1 ♀, Playas de Montalro, iv.1928 (*Clarke & McIntyre*) (TC). **Honduras**: 1 ♀, Morazan, Zamorano, oak quebrada, 1000 m, viii.1948 (*Hubbell*) (UMC). **Mexico**: Tabasco: 1 ♂, Teapa, ii.1904 (*Smith*) (BMNH). **Venezuela**: 2 ♀, Aragua, Portachelo Pass, nr Rancho Grande, iv.1960 (*Test*) (UMC).

Enicospilus hemicrescellae sp. n.

(Fig. 342)

DESCRIPTION. Mandibles moderately long, proximally strongly narrowed, distally more weakly narrowed, apically twisted 30–40°; upper mandibular tooth depressed, 1.3–1.4 times as long as the lower tooth; outer mandibular surface bearing fine sparse pubescence, distally more or less flat, proximally with a shallow ventrobasal concavity. Labrum 0.2 times as long as broad; malar space 0.2–0.3 times as long as basal mandibular width. Clypeus in profile flat, margin blunt; clypeus in front view 1.4–1.5 times as broad as long, with margin slightly convex apically. Lower face 0.65–0.68 times as broad as long, centrally smooth and polished with fine, inconspicuous punctures. Head in dorsal view with genae constricted behind eyes; posterior ocellus more or less contiguous with eye; FI = 70–75%; occipital carina mediodorsally complete, ventrally curved to join hypostomal carina about 0.6–0.7 times the basal mandibular width away from mandible. Antenna long and slender, apically incomplete; 20th segment 2.5–2.6 times as long as broad.

Mesoscutum polished, virtually impunctate, in profile abruptly rounded with anterior margin outturned; notauli vestigial. Mesopleuron polished, the upper part punctate grading to punctostriate, the lower part striate; epicnemial carina curved towards, but not reaching, anterior margin of pleuron. Scutellum in profile moderately convex, laterally carinate for 0.8 or more of its length; scutellum in dorsal view 1.4–1.5 times as long as anteriorly broad, polished, anteriorly smooth but posteriorly with scattered longitudinal wrinkles. Metapleuron moderately convex, longitudinally striate; submetapleural carina evenly anteriorly broadened; posterior transverse carina of mesosternum complete. Propodeum in profile evenly declivous; anterior transverse carina complete or weak at extreme lateral ends, posterior transverse carina absent; anterior area short, steep irregularly rugose; spiracular area quite long, smooth or finely punctate; posterior area transversely wrinkled, with an irregular median longitudinal rugosity; lateral longitudinal carina incomplete posteriorly, joined to spiracular margin by a short carina.

Fore wing length 10–12 mm; discosubmarginal cell as in Fig. 342; AI = 0.78–1.00; CI = 0.22–0.29; ICI = 0.43–0.47; SDI = 1.14–1.34; *cu-a* proximal to the base of *Rs&M* by 0.1 times its own length; marginal cell proximally slightly more sparsely hirsute than it is centrally; 1st subdiscal cell fairly evenly but sparsely hirsute. Hind wing with 5–6 hamuli on *R*1; 1st abscissa of *Rs* straight, 2nd abscissa more or less straight.

Fore leg with tibia slightly flattened, with scattered spines on outer surface. Mid leg with longer tibial spur 1.4–1.5 times length of the shorter. Hind leg with coxa in profile 1.7–1.9 times as long as deep; trochantellus dorsally 0.1 times as long as broad; 4th segment of tarsus 2.5–2.7 times as long as broad; claws of female quite long, evenly curved with stout sparse pectinae; claws of male similar but with pectinae shorter.

Gaster slender; tergite 2 in profile more than 6 times as long as posteriorly deep, laterotergite folded under, thyridia elli4 times its own length. Ovipositor short, straight, its sheath narrow. Male with sternites 6–9 bearing scattered long stout, slightly curved erect hairs; gonosquama apically subacute.

Colour generally pale yellowish, with three dark brown longitudinal mesoscutal vittae; terminal segments of gaster very weakly infuscate; interocellar area yellow; antenna golden; pterostigma yellow; wings hyaline.

VARIATION. None remarkable.

REMARKS. This species is named after the resilient agouti, Small Half Grown, in recognition of her contributions to tropical rodent biology.

Enicospilus hemicrescellae is very similar to *E. gallegosi* in general appearance, and in particular in the form of the alar sclerites (cf. Figs 335 and 342). The two species may be confused unless some care is taken. Their critical features are compared below.

hemicrescellae	*gallegosi*
mandibles more evenly tapered, twisted 30–40°	mandibles distally parallel-sided, twisted 20–30°
flagellum very slender, 20th flagellar segment 2.5–2.6 times as long as broad	flagellum less slender, 20th flagellar segment 2.0–2.3 times as long as broad
hind trochantellus short	hind trochantellus elongate
marginal cell of fore wing sparsely pubescent proximally	marginal cell of fore wing glabrous proximally

BIOLOGICAL INFORMATION. *Enicospilus hemicrescellae* is only known to occur in north-western Costa Rica. It has occasionally been collected in Santa Rosa National Park where isolated specimens have been taken during the dry season. Nothing is known about its biology.

MATERIAL EXAMINED

Holotype ♂, **Costa Rica**: Guanacaste Prov., Santa Rosa National Park, 300 m, iv.1983 (*Janzen & Hallwachs*) (BMNH).

Paratype. **Costa Rica**: Guanacaste Prov.: 1 ♀, Santa Rosa National Park, 300 m, i.1983 (*Janzen & Hallwachs*) (BMNH).

Enicospilus ceciliae sp. n.

(Fig. 344)

DESCRIPTION. Mandibles moderately long, proximally strongly narrowed, with a basal lobe, distally more weakly tapered, apically twisted 20–30°; upper mandibular tooth compressed, 1.3–1.6 times as long as the lower tooth; outer mandibular surface centrally almost flat, sparsely pubescent, and with a strong proximal concavity. Labrum 0.2–0.3 times as long as broad; malar space 0.3–0.4 times as long as basal mandibular width. Clypeus in profile almost flat, margin blunt; clypeus in front view 1.3–1.4 times as broad as long, the margin apically almost truncate; lower face 0.69–0.71 times as broad as long, finely punctate. Head in dorsal view with genae evenly narrowed behind eyes; posterior ocellus very close to eye; FI = 65–70%; occipital carina mediodorsally complete, ventrally curved to almost join or join hypostomal carina about 0.7–0.8 times the basal mandibular width away from mandible. Antenna slender, with 56–59 flagellar segments; 20th segment 2.1–2.2 times as long as broad.

Mesoscutum polished, with vestigial punctures, in profile fairly evenly rounded. Mesopleuron polished, the upper part punctate grading to punctostriate; lower part punctostriate with a coarser rugose-striate band of sculpture extending from epicnemial carina to lower hind corner of mesopleuron; epicnemial carina quite weak, curved towards anterior margin of pleuron. Scutellum in profile moderately convex, laterally carinate for 0.8 or more of its length; scutellum in dorsal view 1.4–1.5 times as long as anteriorly broad, smooth, but posteriorly with some longitudinal wrinkles. Metapleuron convex, punctate; submetapleural carina evenly anteriorly broadened; posterior transverse carina of mesosternum complete. Propodeum in profile quite long and evenly declivous; anterior transverse carina complete, posterior transverse carina absent; anterior area moderately long, rugose; spiracular area quite short, smooth; posterior area reticulate; lateral longitudinal carina more or less complete, usually joined to spiracular margin by a short carina.

Fore wing length 12–14 mm; discosubmarginal cell as in Fig. 344; AI = 0.95–1.10; CI = 0.18–0.29; ICI = 0.45–0.62; SDI = 1.14–1.18; *cu-a* from subopposite to proximal to the base of *Rs&M* by 0.2 times its own length; marginal cell proximally narrowly sparsely pubescent close to *Rs+2r*; 1st subdiscal cell broadly but rather sparsely hirsute. Hind wing with 5–6 hamuli on $R1$; 1st abscissa of Rs straight, 2nd abscissa almost straight.

Fore leg with tibia subcylindrical, with scattered slender spines on outer surface. Mid leg with longer tibial spur 1.4–1.5 times length of the shorter. Hind leg with coxa in profile 1.8–1.9 times as long as deep; trochantellus dorsally <0.1 times as long as broad; 4th segment of tarsus 2.5–2.7 times as long a broad; claws of female rather long, distally abruptly but shortly curved, with close, short pectinae; those of male similar but with pectinae closer together.

Gaster slender; tergite 2 in profile 6–7 times as long as posteriorly deep, laterotergite turned under, thyridia elliptical and separated from anterior margin of tergite by about 2–3 times its own length. Ovipositor slender, more or less straight, its sheath slender. Male with sternites 7–9 bearing scattered, long, erect slightly curved hairs; gonosquama distally evenly rounded.

Colour generally pale yellowish on head and alitrunk, with gaster yellowish brown; legs and antennae golden; interocellar area yellowish; pterostigma yellowish brown; wings hyaline.

VARIATION. *Enicospilus ceciliae* is a morphologically and chromatically uniform species.

REMARKS. *Enicospilus ceciliae* is apparently closely related to *E. dispilus* from which it differs consistently in the form of the alar sclerites (cf. Figs 344, 347–352). The mandibles are slightly more slender than those of *E. dispilus* and most specimens of *E. dispilus* have dark mesoscutal markings; such vittae are never present in *E. ceciliae*.

BIOLOGICAL INFORMATION. *Enicospilus ceciliae* has only been collected in north-estern Costa Rica at two sites 14 km apart. These localities, at altitudes between 300 and 400 m, support quite mature but disturbed, seasonally dry forest. Surprisingly, *E. ceciliae* has not been collected in Santa Rosa National Park. Nothing is known about its natural history.

MATERIAL EXAMINED

Holotype ♂, **Costa Rica**: Alajuela Prov., Río Meno crossing, W. of Santa Cecilia, 350 m, vii.1986 (*Gauld*) (BMNH).

Paratypes. **Costa Rica**: Alajuela Prov.: 2 ♂, Río Meno Xing, W. of Santa Cecilia, 350 m, vii.1986 (*Gauld*) (BMNH): Guanacaste Prov.: 1 ♀, Cerro el Hacha, 300–400 m, i-iv.1987 (*Janzen & Hallwachs*) (BMNH).

Enicospilus dispilus (Szépligeti)

(Figs 140, 143, 213, 214, 347–352)

Ophion (*Eniscopilus*) [sic] *arcuatum* Felt, 1902: 307. Syntypes ♂, ♀, U.S.A. (Albany). [Junior primary homonym of *Ophion arcuatus* Brullé, 1846.]

Henicospilus dispilus Szépligeti, 1906: 145. Holotype ♀, BRAZIL (TM) [examined].

Enicospilus fuscipennis flavostigma Hooker, 1912: 58. Holotype ♀, FRENCH GUIANA (USNM) [examined]. **Syn. n.**

Enicospilus purgatus arcuatus (Felt) Hooker, 1912: 76.

Enicospilus dispilus (Szépligeti) Hooker, 1912: 87.

Enicospilus arcuatus (Felt) Wolcott, 1923: 65.

Enicospilus flavostigma Hooker; Townes & Townes, 1966: 178.

DESCRIPTION. Mandibles moderately long, generally fairly evenly narrowed, though in some larger individuals they may be more or less parallel-sided distally, apically twisted 20–45°; upper mandibular tooth subcylindrical, 1.3–1.8 times as long as the lower tooth; outer mandibular surface with fine scattered pubescence, almost always centrally very slightly concave, and with at most a weak proximoventral concavity. Labrum 0.2–0.4 times as long as broad; malar space 0.2–0.3 times as long as basal mandibular width. Clypeus in profile from almost flat to weakly concave, margin blunt; clypeus in front view 1.3–1.6 times as broad as long, with margin from subtruncate to slightly convex apically. Lower face 0.65–0.80 times as broad as long, centrally usually finely and sparsely punctate. Head in dorsal view with genae generally slightly inflated, but constricted behind eyes; posterior ocellus close to but usually not touching eye; FI = 70–80%; occipital carina mediodorsally almost invariably complete, ventrally curved to join hypostomal carina about 0.4–0.7 times the basal mandibular width away from mandible. Antenna quite long and slender, with 55–63 flagellar segments; 20th segment 1.7–2.1 (or rarely up to 2.4) times as long as broad.

Mesoscutum polished, finely punctate, in profile fairly abruptly rounded; notauli weak but discernible. Mesopleuron polished, the upper part always finely punctate, the lower part from punctate to finely punctostriate; epicnemial carina inclined towards anterior margin of pleuron. Scutellum in profile weakly to moderately convex, laterally carinate for 0.5 or more (usually most) of its length; scutellum in dorsal view 1.3–1.5 times as long as anteriorly broad, generally finely punctate with isolated striae posteriorly. Metapleuron moderately convex, from regularly punctate to rugulose or even almost striate (Fig. 213); submetapleural carina usually evenly anteriorly broadened; posterior transverse carina of mesosternum usually complete, rarely centrally interrupted. Propodeum in profile abruptly declivous; anterior transverse carina from complete to (rarely) completely absent, posterior transverse carina usually absent, sometimes represented by a weak crest laterally; anterior area from smooth to striate, quite deep; spiracular area rather short, more or less smooth; posterior area wrinkled to reticulate, generally with one to several longitudinal rugae, very occasionally either almost smooth or concentrically rugose; lateral longitudinal carina usually virtually absent, very rarely more complete, not joined to spiracular margin by a distinct short carina.

Fore wing length 13–22 mm; discosubmarginal cell as in Figs 347–352; AI = 0.75–1.30; CI = 0.25–0.35; ICI = 0.40–0.70; SDI = 1.14–1.29; *cu-a* proximal to the base of *Rs&M* by 0.1–0.5 times its own length; marginal cell proximally usually rather sparsely hirsute, sometimes broadly glabrous; 1st subdiscal cell with anterior and distal margins narrowly to quite broadly hirsute. Hind wing with 5–8 hamuli on *R*1; 1st abscissa of *Rs* straight (Fig. 143), 2nd abscissa usually straight.

Fore leg with tibia slightly flattened, with scattered spines on outer surface. Mid leg with longer tibial spur 1.3–1.5 times length of the shorter. Hind leg with coxa in profile 1.6–1.8 times as long as deep; trochantellus dorsally 0.1 or less times as long as broad (Fig. 140); 4th segment of tarsus 2.1–2.4 times as long as broad; claws of female long, bearing long fine pectinae, apically abruptly curved; claws of male similar but with pectinae a little shorter.

Gaster long and slender; tergite 2 in profile more than 6 times as long as posteriorly deep, laterotergite folded under, thyridia oval to elliptical and separated from anterior margin of tergite by about 3–4 times its own length. Ovipositor slender, its sheath narrow. Male with sternites 6–9 bearing dense long stout erect pubescence (Fig. 214); gonosquama apically subacute.

Colour generally brownish yellow, usually with head paler yellow; mesoscutum sometimes with dark vittae, terminal segments of gaster from brownish yellow to blackish; interocellar area yellow; antenna golden; pterostigma yellowish to brownish; wings hyaline to weakly infumate.

VARIATION. This species shows exceptional variation in a range of features. The most obvious is in the form of the alar sclerites (Figs 347–352), though the proximal sclerite is always more or less regularly triangular and the distal sclerite, if present, is confluent with its distal corner. The most frequently encountered configuration is for the fenestra to be moderately long, the distal sclerite to extend around about two-thirds of its periphery, and for the central sclerite to be more or less oval to D-shaped and positioned closer to the distal margin of the fenestra than it is to the proximal sclerite (Fig. 350). The holotype of *Enicospilus flavostigma* has such an alar configuration. A few individuals are similar but have the distal sclerite very reduced (Fig. 351). A large number of individuals have the central sclerite strong and almost circular, and also have a strong complete distal sclerite (Fig. 352). Frequently, in such individuals, the fenestra may be exceptionally short, so the central sclerite appears to be positioned almost centrally (Fig. 349). The holotype of *Enicospilus dispilus* has such an alar configuration. A number of specimens have the distal sclerite obliquely D-shaped, with the long straight side directed posteromedially; other specimens have a weak crescent-shaped central sclerite (Figs 347–348).

Coloration is also variable. Typically this is a rather pale yellowish species, and over much of its range it is not dark-marked. However, many specimens in tropical Central and South America have well-defined dark mesoscutal vittae, and I have seen one population (from Virgen de Socorro, Costa Rica) which have more or less the entire mesoscutum black. Many dark-marked individuals also have the posterior segments of the gaster infuscate and a few have tergites 3+ entirely black.

Sculpture is also variable. Typically the posterior area of the propodeum is irregularly wrinkled to rugose, with one to several median longitudinal rugae. In some specimens the entire area is concentrically rugose, whilst in the north of its range many have an almost smooth propodeum. The anterior transverse carina is usually complete, but in some individuals from the eastern United States, and from Central America, this carina can be extremely reduced. Some such individuals also have the posterior transverse carina of the mesosternum centrally incomplete. Specimens with finer propodeal sculpture usually have the metapleuron punctate, as do many other individuals, but some have coarse rugae present anterodorsally.

The general shape of the mandibles is quite uniform though those of some individuals are stout and weakly twisted apically (*ca* 20°), whilst others have a slender, strongly twisted mandible (*ca* 40–45°).

A group of specimens from Guanacaste Province, Costa Rica (with a vestigial anterior transverse propodeal carina, and a concentrically rugose posterior area) are remarkable in having extremely long erect hairs on the posterior gastral sternites. Those on sternite 8 are almost as long as the sternite.

Remarks. For many years this species has been called *Enicospilus arcuatus* (Felt) (in, for example, Townes & Townes, 1966; Carlson, 1979) despite the fact that this name is unavailable as it is a homonym. The earliest available name I have found that definitely applies to this species is *dispilus* (Szépligeti, 1906). However, I have not been able to locate the type of *bifoveolatus* (Brullé, 1846), a North American species, and it is possible that this name may apply to this species.

Enicospilus dispilus is one of the most extraordinarily variable species of the genus that I have seen. There are a large number of fairly distinctive morphotypes, but I have chosen not to regard these as separate species for the following reasons: 1) intermediates can be found between these morphotypes; 2) although at any one site one to several morphotypes may be recognizable (for convenience call them A and B), at a different locality other morphotypes may exist which combine some 'distinctive' features of A with B and B with A to give other (and at that site separable) morphotypes; 3) any key to the morphotypes is unlikely to be workable as collecting at new sites often yields another morphotype with another combination of features; 4) every series of more than a few individuals from any one locality contains two or more morphotypes; 5) to call the several morphotypes 'species' obscures a real biological phenomenon which requires further study.

Biological Information. *Enicospilus dispilus* is an extremely widely distributed species (Map 32) whose range extends from southern Ontario and Quebec (47°N) south to Argentina and Cautin Province, Chile (c. 39°S). In Central America, although it has never been found in large numbers at any one site, it is overall one of the most frequently collected species of *Enicospilus*. It has been taken at almost every site sampled from sea-level up to about 2000 m. It seems to be most frequently encountered in habitats which have suffered agricultural disturbance, and it is relatively uncommon in cloud forest sites. For example, despite intensive collecting only a few individuals have been taken in cloud forest at Monteverde, Costa Rica (4 specimens). In Santa Rosa National Park it is quite frequently collected. Most specimens have been taken at the beginning and end of the wet season, and only isolated examples have been collected in the driest months of the year. Its cumulative seasonal distribution for 1977–86 is:

J	F	M	A	M	J	J	A	S	O	N	D
5	–	1	1	7	14	5	3	2	4	2	9

In Costa Rica *E. dispilus* has been collected in the following localities: Finca Campana at 5 km NW. of Dos Ríos, Finca San Gabriel at 16 km ENE. Quebrada Grande, San Ramón Forest Reserve and Virgen de Socorro, in Alajuela Province; Turrialba in Cartago Province; Finca Biesnan at 11 km E. Quebrada Grande, Rincón National Park, Santa Rosa National Park and Casa Mariksa (= Maritza) on the lower slopes of Volcán Orosi in Guanacaste Province; Monteverde in Puntarenas Province; Braulio Carrillo National Park in San José Province.

On Barro Colorado Island, Panama relatively few individuals have been collected, but the cumulative data for 1978–85 are:

J	F	M	A	M	J	J	A	S	O	N	D
–	–	–	2	5	3	2	1	3	–	–	1

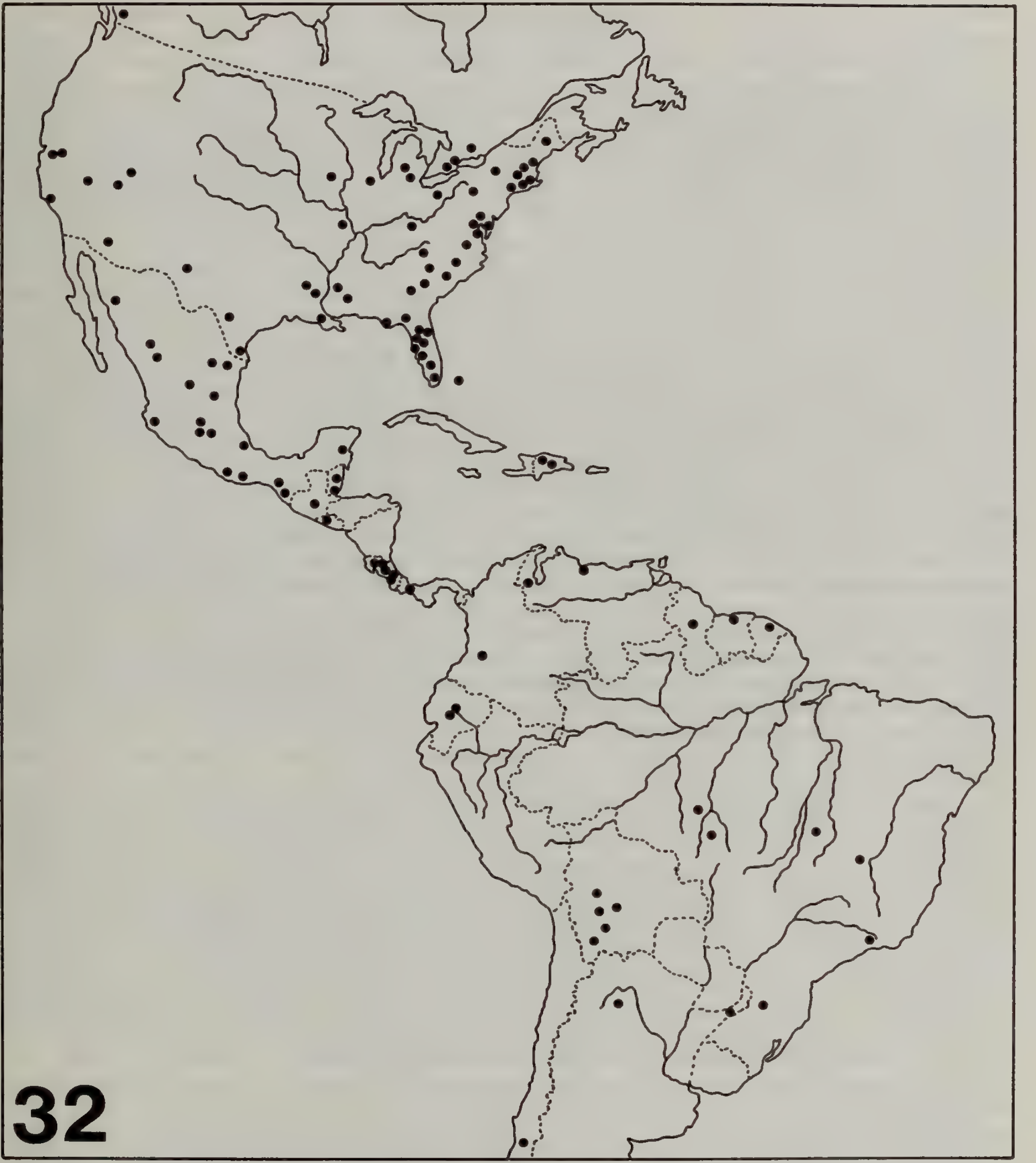
Enicospilus dispilus is an endoparasitoid of the larvae of a variety of species of Noctuidae and Notodontidae that eat the leaves of large trees. In Costa Rica I have seen one female of this species reared in Santa Rosa National Park from the larva of a noctuid (rearing reference number 84-SRNP-1149) found feeding on oak (*Quercus oleoides*). The host larva began to spin up on the 15th June and the parasitoid emerged less than one month later on 18th July. A second female was reared in the same locality from an unidentified species of notodontid found feeding on *Chlorophora* (87-SRNP-901).

In North America, judging from the incidence of reared individuals in museum collections, *E. dispilus* is a fairly common larval endoparasitoid of the notodontids *Heterocampa guttivitta* (Walker) and *Schizura concinna* (Smith). I have also seen individuals reared from *Hippia packardi* Morrison, *Nadata gibbosa* (Smith) (in USNM) and *Heterocampa mantea* (in CNC) (Lepidoptera: Notodontidae) and a single specimen allegedly reared from *Cirphis unipuncta* (Haworth) (Lepidoptera: Noctuidae). *E. dispilus* has also been recorded as a parasitoid of the noctuid *Scoliopteryx libatrix* (L.) (Carlson, 1979), and in southern South America it is recorded as a parasitoid of *Alabama argillacea* (Hübner) (Lepidoptera: Noctuidae) (DeSantis, 1941; DeSantis & Esquivel, 1966).

Material Examined

Holotype ♀ (*Henicospilus dispilus* Szépligeti), **Brazil**: Minas Gerais, 1897 (TM). Holotype ♀ (*Enicospilus fuscipennis flavostigma* Hooker), **French Guiana**: Cayenne (USNM).

370 ♂, 486 ♀, from the following localities: **Argentina** (Misiones, Tucumán); **Bahamas** (Grand Bahama); **Belize; Bolivia** (Chapare, Cochabamba, Santa Cruz); **Brazil** (Bahia, Mato Grosso, Rio de



Map 32 Localities at which *Enicospilus dispilus* has been collected.

Janeiro, Santa Catarina); **Canada** (British Columbia, Ontario, Quebec); **Chile** (Cautin); **Colombia** (Valle); **Costa Rica** (Alajuela, Cartago, Guanacaste, Puntarenas, San José); **Dominican Republic; Ecuador** (Pichincha); **El Salvador; Guatemala; Guyana; Mexico** (Chiapas, Durango, Guerrero, Jalisco, Mexico State, Neuvo León, Quintana Roo, San Luis Potosí, Sonora, Veracruz); **Panama; Peru** (Huanuco, Lima, Loreto); **Surinam; U.S.A.** (Arizona, Arkansas, California, Colorado, Connecticut, Delaware, District of Columbia, Florida, Georgia, Illinois, Iowa, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Mississippi, Missouri, Nevada, New Hampshire, New Mexico, New York, North Carolina, Ohio, Pennsylvania, Rhode Island, South Carolina, Tennessee, Texas, Virginia). **Venezuela** (Aragua). (In BMNH, CAS, CNC, FSCA, TC, UMC, USNM.)

Enicospilus echeverri sp. n.

(Figs 319, 346)

Description. Mandibles moderately long, fairly evenly tapered, apically twisted 35–45°; upper mandibular tooth subcylindrical to slightly depressed, 1.4–1.6 times as long as the lower tooth; outer mandibular surface bearing isolated pubescence, distally flat, proximally with a weak shallow concavity. Labrum 0.2–0.3 times as long as broad; malar space 0.2–0.3 times as long as basal mandibular width. Clypeus in profile very weakly convex, margin blunt to subacute; clypeus in front view 1.3–1.5 times as broad as long, with margin subtruncate apically. Lower face 0.71–0.76 times as broad as long, centrally sparsely punctate, sometimes with punctures elongate and tending to punctostriate. Head in dorsal view with genae rounded behind eyes; posterior ocellus close to eye; FI = 70–75%; occipital carina mediodorsally complete, ventrally curved to join hypostomal carina about 0.6–0.9 times the basal mandibular width away from mandible. Antenna long and slender, with 53–56 flagellar segments; 20th segment 2.0–2.2 times as long as broad.

Mesoscutum polished, finely punctate, in profile abruptly rounded; notauli vestigial. Mesopleuron polished, the upper part rather sparsely punctate, the lower part punctate, occasionally tending to punctostriate; epicnemial carina curved towards but not reaching anterior margin of pleuron. Scutellum in profile weakly convex, laterally carinate for 0.9 or more of its length; scutellum in dorsal view 1.5–1.6 times as long as anteriorly broad, punctate and usually with some longitudinal striae posteriorly. Metapleuron weakly to moderately convex, punctate, occasionally with isolated striae posterodorsally; submetapleural carina evenly anteriorly broadened; posterior transverse carina of mesosternum complete. Propodeum in profile fairly abruptly declivous; anterior transverse carina complete, usually very strong laterally, posterior transverse carina usually represented by vestigial lateral crests; anterior area steep, centrally striate; spiracular area long, smooth or very finely punctate; posterior area reticulate; lateral longitudinal carina present anteriorly, sometimes complete, joined to spiracular margin by a short carina.

Fore wing length 15–17 mm; discosubmarginal cell as in Figs 319, 346; AI = 1.04–1.25; CI = 0.25–0.36; ICI = 0.39–0.43; SDI = 1.25–1.41; *cu-a* usually proximal to the base of *Rs&M* by its own thickness, rarely by up to 0.2 times its own length; marginal cell proximally slightly more sparsely hirsute than it is centrally; 1st subdiscal cell usually rather sparsely hirsute. Hind wing with 6–7 hamuli on *R*1; 1st abscissa of *Rs* very slightly bowed, 2nd abscissa almost straight.

Fore leg with tibia slightly flattened, with scattered spines on outer surface. Mid leg with longer tibial spur 1.5–1.7 times length of the shorter. Hind leg with coxa in profile 1.7–1.9 times as long as deep; trochantellus dorsally 0.1 times as long as broad; 4th segment of tarsus 2.0–2.2 times as long as broad; claws of female quite long, bearing fine pectinae, apically evenly curved; claws of male similar but more finely pectinate.

Gaster long and slender; tergite 2 in profile more than 6.0 times as long as posteriorly deep, laterotergite folded under, thyridia elliptical and separated from anterior margin of tergite by about 3–4 times its own length. Ovipositor slender, its sheath narrow. Male with sternite 7 and extreme anterior part of sternite 8 bearing two rows on short, stout closely packed hairs; remainder of sternite 8 and sternite 9 with fine decumbent pubescence; gonosquama distally rounded.

Colour generally reddish brown, head and usually also the scutellum paler yellow, mesoscutum with three dark longitudinal vittae, gaster with tergites 3+ infuscate; interocellar area yellowish; antenna brownish to almost black; pterostigma brownish; wings weakly infuscate.

Variation. Specimens from Brazil tend to have the alitrunk more brightly yellowish than Central American specimens.

Remarks. This species is named in honour of Gustavo Echeverri for his contributions to the Guanacaste National Park, Costa Rica.

Enicospilus echeverri is apparently very closely related to *E. lacsa*. Both species are similar in general appearance and have identical and highly modified male terminal gastral sternites (Fig. 200). *E. echeverri* can most easily be distinguished from *E. lacsa* by the distally more acute central sclerite (cf. Figs 345, 346), its stouter flagellar segments, coloration and rather broader face.

Biological Information. *Enicospilus echeverri* is a fairly widely distributed species whose range extends from about 19°N in southern Mexico, south to Rio de Janeiro, Brazil (23°S). It has been collected from near sea-level up to about 1400 m. In Santa Rosa National Park only isolated specimens have been collected between March and August. Nothing is known of its host range.

Material Examined

Holotype ♀, **Costa Rica**: Guanacaste Prov., Santa Rosa National Park, 300 m, vi.1984 (*Janzen & Hallwachs*) (BMNH).

Paratypes. **Brazil**: 1 ♂, 15 ♀, Bahia, Encruzilhada, 960–980 m, xi.1972–4 (*Alvarenga*) (TC); 1 ♀, Minas Gerais, Pedra Azul, 800 m, xi.1972 (*Alvarenga & Seabra*) (TC); 1 ♀, Rio de Janeiro, Itatiaia National Park, x.1969 (*Otero*) (TC). **Costa Rica**: Guanacaste Province: 1 ♀, Santa Rosa National Park, 300 m, viii.1977 (*Janzen*) (TC); same locality, 1 ♀, vi.1982, 1 ♀, iii.1983 (*Janzen & Hallwachs*) (BMNH); 1 ♀, Volcán Cacao, Finca La Luz [= Estacion Mengo], 1100 m, viii.1986 (*Janzen & Hallwachs*) (BMNH); 1 ♀, same locality, vi.1987 (*Janzen*) (BMNH): Puntarenas Prov.: 1 ♀, Monteverde, 1300–1400 m, vii.1982 (*Janzen & Hallwachs*) (BMNH). **Mexico**: Chiapas: 1 ♀, 32 km N Huixtla, 1000 m, vi.1969 (CNC): Oaxaca: 1 ♀, 19 km S. Valle Nacional, 1000 m, v.1971 (*Howden*) (TC): Veracruz: 1 ♀, Cordoba, v.1906 (*Knab*) (USNM). **Panama**: 1 ♂, 2 ♀, Barro Colorado Island, 120 m, vi-vii.1984–5 (*Wolda*) (BMNH).

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Milkweed butterflies: their cladistics and biology

P. R. Ackery & R. I. Vane-Wright

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